



# THE MONIST

A Quarterly Magazine

Devoted to the Philosophy of Science.

Editor: DR. PAUL CARUS.

Associates: { E. C. HEGELER.  
MARY CARUS.

## CONTENTS:

	PAGE
THE NATURE OF VITAL PROCESSES ACCORDING TO RIGNANO. BASIL C. H. HARVEY. ....	321
HAS THE PSYCHOLOGICAL LABORATORY PROVED HELPFUL? LORENZO MICHELANGELO BILLIA. ....	351
A BIOCHEMICAL CONCEPTION OF THE PHENOMENA OF MEMORY AND SENSATION. T. BRAILSFORD ROBERTSON. ....	367
PSYCHOLOGY A DOMAIN OF ITS OWN. EDITOR. ....	387
CRITICISMS AND DISCUSSIONS.	
Easy Non-Euclid. G. B. HALSTED. ....	399
Construction of the Straight Line. EDITOR. ....	402
Some Remarks on Mr. Russell's Article, "A Modern Zeno." W. H. BUSSEY... ..	407
Professor Lovejoy on "Der vorchristliche Jesus." W. B. SMITH. ....	409
The Future of Artificial Languages. A. H. MACKINNON. ....	420
A Defense of International Language. O. H. MAYER. ....	425
Esperanto, Ilo and Malay. EDITOR. ....	430
Experience de double traduction en langue internationale. L. COUTURAT. ....	432
A Magic Cube of Six. H. M. KINGERY. ....	434
A New Method for Making Magic Squares of an Odd Degree. L. S. FRIERSON... ..	441
Overlapping Magic Squares. D. F. SAVAGE. ....	450
The Bagpipe Not a Hebrew Instrument. PHILLIPS BARRY. ....	459
Credulity, Incredulity, and Immortality. W. E. AYTON WILKINSON. ....	461
The Old and the New (In Reply to Mr. W. E. Ayton Wilkinson). EDITOR....	468
BOOK REVIEWS AND NOTES. ....	474

(For particulars see inside title-page.)

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## THE OPEN COURT

AN ILLUSTRATED MONTHLY MAGAZINE

Devoted to the Science of Religion, the Religion of Science, and the  
Extension of the Religious Parliament Idea

Editor: DR. PAUL CARUS

Associates: { E. C. HEGELER  
                  { MARY CARUS

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Leaders of Religion of all Denominations.

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Devoted to the Philosophy of Science

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**T**HE PHILOSOPHY OF SCIENCE is an application of the scientific method to philosophy. It is a systematization of positive facts; it takes experience as its foundation, and uses the formal relations of experience (mathematics, logic, etc.) as its method. All truths form one consistent system and any dualism of irreconcilable statements indicates a problem arising from either faulty reasoning or an insufficient knowledge of facts. Science *always* implies Monism *i. e.* a unitary world-conception.

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## CONTENTS:

	PAGE
THE NATURE OF VITAL PROCESSES ACCORDING TO RIGNANO. BASU C. H. HARVEY. ....	321
THE PSYCHOLOGICAL LABORATORY PROVED HELPFUL? LORINZO MICHELANGELO BILLIA. ....	351
A BIOCHEMICAL CONCEPTION OF THE PHENOMENA OF MEMORY AND SENSATION. T. BRAILSFORD ROBERTSON. ....	367
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The Old and the New (In Reply to Mr. W. E. Ayton Wilkinson). EDITOR....	468
BOOK REVIEWS AND NOTES.	
Anti-Pragmatisme, <i>A. Schinz</i> , 474.—Allgemeine Geschichte der Philosophie, <i>P. Deussen</i> , 475.—Récréations mathématiques, <i>W. Rouse Ball</i> , 475.—Abriss der Algebra der Logik, <i>Eugen Müller</i> , 475.—The New Schaff Herzog Encyclopedia of Religious Knowledge, <i>S. Macauley Jackson</i> , <i>Chas. C. Sherman</i> , <i>G. W. Gilmore</i> , and others, 476.—The Place of Animals in Human Thought, <i>Evelyn Martinengo Cesaresco</i> , 476.—L'année biologique, <i>Yves Delage</i> , 477.—Aids to Worship, <i>Malcolm Quin</i> , 477.—Der Skeptizismus in der Philosophie, <i>Raoul Richter</i> , 478.—Sociologie de l'action, <i>E. de Roberty</i> , 478.—Zur Wiedergeburt des Idealismus, <i>J. Schmidt</i> , 478.—Witelo, ein Philosoph und Naturforscher des 13. Jahrhunderts, <i>C. Baumker</i> , 478.—Les erreurs de la science, <i>L. C. E. Vial</i> , 479.—Cournot et la renaissance du Probabilisme au xix. siècle, <i>F. Mentré</i> , 479.—The Accadian Affinities of the Chinese, 479.—Notes on the Development of a Child, 480.—Psychology of Prophecy, 480.—Voraussetzungen und Ziele des Erkennens, 480.	

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# THE MONIST

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## THE NATURE OF VITAL PROCESSES ACCORDING TO RIGNANO.

EUGENIO RIGNANO of Milan, Italy, engineer and student of philosophy, has recently published a book treating in an original and suggestive way the fundamental problems of biology.<sup>1</sup> In it are introduced some new conceptions which seem to point the way to the solution of many important questions, and which are intensely interesting at just the present stage of biological science. The extensive reference made to them by Prof. Francis Darwin in his presidential address delivered before the British Association for the Advancement of Science at their Dublin meeting last August, illustrates the growing appreciation among English-speaking scientists of the significance and value of Rignano's work. In this paper an attempt is made to present in English his fundamental hypothesis and some of its most interesting consequences and applications.

He has approached these problems in a somewhat different way from that of most authors who have written upon them. He was not primarily a biologist but a physicist. All his work shows evidence that he was a master of physical chemistry, and that he takes the keenest interest in scientific philosophy in general. He was led to the

<sup>1</sup> Eugenio Rignano, *Ueber die Vererbung erworbener Eigenschaften*. Leipzig: Engelmann, 1907.

study of biological problems by their vital relation to the results of other sciences and by their intrinsic interest from the standpoint of positive philosophy. Along these lines he has been an earnest worker, having contributed many thoughtful and scholarly articles to the *Revista di Scienza* and to other periodicals of a similar character.

Being attracted in this way to a consideration of biology, he devoted himself to a study of the facts presented by investigators and especially of the general conceptions developed from them by leading naturalists from Lamarck to the present time, a study, as his book clearly shows, of a most appreciative and discriminative kind. He found the general conceptions not wholly satisfactory and, sometimes, even contradictory of one another, and realizing that facts cannot be contradictory or misleading, he sought to see for himself the underlying basic principles which should explain and unify the facts, and at the same time perhaps indicate an outlet from the blind alley in which some biological inquiries at present find themselves stalled. In relation to the fundamental biological problem, that of the essential nature of the vital process itself, he found that "biologists are inclined to fall into two opposite extremes." He continues (pp. 359-361):

"Some deny flatly the possibility of ever arriving at a comprehension of the nature of life. But if we ask ourselves in what this comprehension of the nature of life could consist, from the point of view of positive philosophy, we have no difficulty in recognizing that everything must be reduced to comparing vital phenomena with some physico-chemical model already known, suitably modified by the particular special conditions imposed upon it so that just these special conditions shall determine the differences which exist between this vital phenomenon and that phenomenon of the inorganic world closest related to it. If this be so it is then the duty of science emphatically to

reject such a denial of scientific thought as would be constituted by the renunciation of this conception. Whether one clearly recognizes it or not, it is just this search for the nature of the vital principle which properly constitutes the principal object and the final goal of all biologic study in general.

"Others, again, are not willing to accord to life even the slightest property which should not be simply physico-chemical in nature. Among all these, it is enough to cite the example of Verworn who not only relegates assimilation to the category of purely chemical phenomena, by means of his biogenic hypothesis, but who would explain protoplasmic currents, the protusion of pseudopodia, the movements of cilia, and in general all movements of living beings by a double and alternative chemotropism of protoplasmic substance rather than by currents of nervous energy. Protoplasmic substance in fact according as it remains unstimulated or is stimulated, that is, partially decomposed by the stimulus which would agitate it mechanically, would possess a chemical affinity for the oxygen of the environment or for the substances produced by the nucleus capable of rebuilding the partially decomposed protoplasmic substance. And to this alternation of different affinities, the opposite protoplasmic movements of expansion and contraction would correspond.<sup>2</sup>

"Now it is evident that this endeavor not to attribute to vital energy any specific nature of its own, and consequently to explain even the most characteristic phenomena of life by means of only those energies which physics and chemistry afford us to-day, can have no more success than as if one should attempt to explain chemical phenomena by means of physical phenomena only. And this endeavor is also quite unjustified. For the conception that

<sup>2</sup>Verworn, *Die Biogenhypothese*. Jena: Fischer, 1903; and *Die Bewegung der lebendigen Substanz*, especially pp. 100-103.

the form of energy on which vital phenomena are based is different from all forms of energy which have hitherto been observed in non-living bodies, has absolutely nothing unscientific in it, any more than the conception, for example, that electricity may also be a form of energy different from all others.

"Vital energy, nervous energy, we admit at once, will certainly be a particular case of the more general physico-chemical forms of energy already known or yet to be known, and as such it must necessarily be subject to the laws which control these latter; and also, *a fortiori*, to the laws which control all energy in general. But even as such, that is as a particular case of more general, physico-chemical forms of energy, it will have besides further special laws of its own which are only experimentally to be determined and cannot simply be deduced from the more general laws even though it must always be subjected to them. And it is just these laws of its own which, out of a physico-chemical energy, make it vital energy. This conception has led us to attribute to nervous energy, set forth as the basis of life, special properties, which electric energy, in certain respects related to it, does not possess."

In accordance with this conception of the nature of vital energy Rignano developed a hypothesis of the fundamental vital processes which characterize all living matter. His theory is based upon well-known physical phenomena of electric energy; and by the hypothesis of certain specific qualities which this form of energy might be supposed to possess in the conditions existing in living matter, he has endeavored to account for the essential and distinctive properties of living matter. But such a conception, if it be true, must constitute not only a direct explanation of the fundamental properties which living matter always presents, namely assimilation, growth, and reproduction; it must also explain to some extent all the forms of activity

which vital energy ever manifests in biological processes, —polarity, rhythm, periodicity, mitotic division, fecundation, ontogeny with its recapitulation of phylogeny, atavism, heredity, memory, etc.,—the fundamental character of the vital process must be inherent in all these developments of it; a clear conception of their common basis must help us greatly to understand all of them, and must also tend to unify them, explaining their curious likeness to one another, as for instance the likeness of ontogeny and memory, so often observed, but so difficult to grasp and understand.

As one reads Rignano's book, and follows him in the consideration of one after another of these vital phenomena, and notes how harmoniously they accord with the hypothesis he suggests, the impression becomes steadily stronger that this is the line along which the final solution of the problem must be sought. Rignano does not claim that his suggestion furnishes the final solution, but submits it provisionally in the hope that it may serve to point the way to an ultimate complete understanding. He says (p. 387):

"We do not venture to offer this as a true and proper hypothesis. The phenomenon of life is still too little established for so bold a venture. We consider it only as a provisional scheme of the vital process which may serve as an initial concrete basis for further investigation into the nature of life. For in affording any firm provisional basis upon which the discussion of a question still entirely without solution can be supported, one attains always the great result of determining definitely the conditions of the question, of demonstrating clearly the untenability of certain views, which was not possible formerly while the question had yet too indefinite a form, and of bringing us in this way slowly but certainly nearer to a correct understanding of the phenomenon, in proportion as after dis-

carding the untenable propositions, the tenable stand out ever more clearly and convincingly and thereby are given firmer foundation."

In his book the author develops his hypothesis in an inductive way—proceeding from a consideration of ontogeny, but in this necessarily briefer review, it has seemed better not to follow the lengthy inductive method, but to state the theory at once in connection with one of the phenomena which it helps to explain. It might be presented in connection with any of the vital phenomena, since the fundamental process may be seen in all those built up upon it. A consideration of memory may serve as a good way of approach.

#### EXPLANATION OF MEMORY.

Explanations of this familiar but marvelous faculty have not been very clear or complete, but those who have developed any conception of its mechanism have been inclined to attribute it to some change in the material substance of the brain cells, produced by nervous currents passing to them.

Thus Hering states as quoted by Rignano (pp. 344-345): "We see how an entire group of experiences becomes reproduced in proper order of space and time, and with such vividness that it might deceive us as to the reality of what long since ceased to be present. This shows us, in a most striking way, that even after the sensation and perception in question has long since disappeared, there remains still in our nervous system a material trace, an alteration of the molecular or atomic connections by which the nervous substance is rendered capable of reproducing these physical processes by which the corresponding psychic process of sensation and perception is determined. . . . The representations do not last as representations but what does persist is that particular attunement of the nervous



substance, in virtue of which, when it is properly struck, it sounds again to-day the same note which it gave forth yesterday."<sup>3</sup>

"When we speak," writes Maudsley, "of a trace, vestige or residuum all we mean to imply is that an effect is left behind in the organic element, a something retained by it which disposes it to a similar functional act; a disposition has been acquired which differentiates it henceforth, although we have no reason to think that there was any original specific difference between one nerve cell and another."<sup>4</sup>

These conceptions constitute at best only an inadequate because indefinite explanation of the real problem of memory. The essential characters of this faculty are thus stated by Ribot. "Of the three elements of memory: the preservation of certain states, reproduction, localization in the past, the first two alone are necessary and characteristic." A true explanation must show definitely how these states are preserved, and how they are repeated. Rignano agrees with these conceptions in the belief that our specific sensations and perceptions are due to the passage through the nervous system of specific nervous currents, called forth by specific stimuli in the environment, and that the repetition of these specific sensations in memory depends upon specific changes induced in the nerve cells. But he goes farther, stating in his hypothesis (p. 344) what these specific changes in the nerve cells are.

"This something which leaves an impression after it in the nerve cell and which disposes it to other similar functional acts will be to our mind, a real and specific material residue of substance capable of reproducing the same func-

<sup>3</sup> Ewald Hering, *Ueber das Gedächtnis als eine allgemeine Funktion der organisierten Materie*. Vienna: Gerold, 1876, pp. 8, 9. English translation published by Open Court Pub. Co., pp. 7 and 9.

<sup>4</sup> Henry Maudsley, *The Physiology of Mind*, third edition, London, Macmillan, 1876, p. 270. Quoted by Rignano pp. 343-344.

tional current as that by which it had itself been deposited." These specific substances so deposited he calls specific mnemonic elements.

"In just this quality of being able to restore again the same specificity of nervous current as that by which each element had been deposited one would look for the cause of the mnemonic faculty in the widest sense. . . . And further, the very essence of the mnemonic faculty would consist entirely in this restitution" (p. 342). This conception, it will be noted at once, is not very different from those already advanced. "The only new thing comprised in it is the hypothesis that the substance, whose discharge is thus able to generate a given nervous current, has been produced and deposited exclusively by a nervous current of the same specificity but of reverse direction, and could have been produced and deposited only by such a current. But in this hypothesis, simple as it is, lies everything; for it is just this which alone can explain completely the fundamental law of the reversibility of the relation between action and reaction, stimulus and impression, which governs all organic life" (p. 321).

Such specific elements do not, of course, permit of actual demonstration and their existence is purely hypothetical. The hypothesis is one, however, which is strongly indicated by the facts. Specific accumulations indicate specific accumulators, and these seem likely to be material and substantial since their activity depends upon nutrition, and the nerve cells containing them are material and substantial things. Rignano says (pp. 311-318):

"We should now examine a little more nearly this hypothesis. . . . that the substance which constitutes each specific element, and which is capable of giving as discharge a single well-determined specific nerve-current, is the same and the only substance which this specific nerve current can in its turn form and deposit.

"This should not appear so very strange to us, since the inorganic world itself presents a phenomenon similar in certain respects. The substance which actually constitutes the charge of ordinary electric accumulators is capable of giving back inversely, during its discharge, the same kind of energy which it had previously received, and by which it had itself been deposited, namely, the continuous electric current.

"The most important difference consists in this, that an electric accumulator is capable of restoring always only one and the same kind of energy, but not solely such or such specific mode of this energy, as, for example, only such or such intensity of current. It constitutes, for that reason, only a generic potential element; but such accumulators would attain the completeness of specific potential elements—receiving and restoring instruments of the greatest delicacy—if one could make it possible that each one of them should restore only a single definite intensity of current.

"The analogies and differences which nerve-currents present, in comparison with electric currents, quite warrant us in assuming in nerve-currents some of the properties of electric currents, and to attribute at the same time to the first other properties which the electric do not possess, provided these qualities are not incompatible with one another.

"It is known that, if we designate by  $E$  the electromotor force of an accumulator or of any electro-chemical generator, it can furnish currents of a given intensity  $i$ , according to the resistance  $R$  of the circuit, according to the equation  $i = E/R$ .

"Thus,—even though the terms of motor force, of resistance, of intensity, or more generally, of specificity, transferred from electric to nerve currents, must be quite vague,—we may very well venture, nevertheless, as preliminary hypothesis, to attribute to nerve-currents as

among the properties they might have analogous to electric currents, precisely those contained in this equation."

Rignano then goes on to state certain corollaries following from this hypothesis, which applying to the mnemonic process, account for certain of its characteristic phases.

"As it involves nothing incompatible with the properties expressed by this equation, we may imagine a nervous accumulator, constituted by a given substance, capable of being produced and deposited solely by currents of a definite intensity, or specificity, and at the same time capable of producing, by its decomposition, this current alone,—now from discharge and in the contrary direction,—of the same intensity or specificity  $i$  as that of the charge." This property exhibited by mnemonic elements would cause memories to produce the same sensations, and often also physiologic actions as were formerly produced in the original experience. "This accumulator, then, will discharge itself and produce this current as often as its nervo-motive force, which we may still call  $E$ , is sufficiently great to overcome the respective resistance, according to the equation:  $E = iR$ .

"Finally, we can assume that the magnitude of this nervo-motive force is proportional to the quantity or mass of the substance, which is gradually deposited and accumulated, as if the successive infinitesimal deposits of this substance were innumerable little Leyden jars arranged in relation, one to another, in some serial order. Then the greater the mass of the specific substance of this nervous accumulator the greater in proportion will be the resistance which its discharge will be able to overcome. At the same time, this accumulator capable of surmounting by its current of a predetermined intensity  $i$ , a given resistance  $R$ , will be capable also of surmounting every other resistance less great than  $R$ ; for, for that, it will suffice that it

is not the total quantity of material at disposal that enters into action, but only a portion more or less large, so as to furnish for each resistance  $R' < R$ , the nervo-motor force  $E' < E$ , given by the formula:

$$E' = iR'.$$

"Suppose now that the discharge of this accumulator on account of the ubication or the mode of its insertion, is able to flow only upon a given point of a given plexus, traversed the length of its meshes by as many currents of the most diverse specificities, capable of combining one with another and of decomposing, and in dynamic equilibrium among themselves. (It may be remarked here that the expression 'dynamic equilibrium' of a circulatory system is always to be understood in the sense of inalterability for the time, in the conditions of movement at each point of the system. Thus, for example, the system of distribution of the drinking water of a city, which is fed from a given constant number of basins, whose head of water is maintained always at the same height, and in which a given constant number of water taps are always open, will settle in a short time into a dynamic equilibrium in our sense, and continue in it so long as the accession of a new basin, for example, or the opening of other water taps does not affect the transition to a new dynamic equilibrium.)

"As soon as the discharge of this nervous accumulator occurs, which can produce thus only a single definite specificity of current, and discharge itself upon only a single determined point, it will necessarily effect a single very definite change in the dynamic equilibrium of this given circulatory system. And in the cases in which this change of the dynamic equilibrium requires the doing of a certain amount of work (which theoretically is not always required), this required expenditure of work or energy will be definitely determined for each discharge, and can be

provided only by the accumulator itself. Consequently, in order that the discharge may take place, this quantity will have to be less than, or at most equal to, that which the accumulator can actually furnish.

"The quantity of work which each accumulator is capable of furnishing will necessarily be proportional to the mass of the substance which constitutes it. And since, as we saw, the resistance  $R$  which each accumulator with its current of definite specificity  $i$ , is able to surmount, is likewise proportional to the mass of the substance of the accumulator (because it is proportional to its nervo-motive force, which also is in its turn proportional to this mass, according to the preliminary hypothesis), then the quantity of work required to effect the change under consideration, must be regarded as equivalent to a resistance  $R$ , which opposes the discharge.

"If now we admit that in nearly all cases, which come into consideration here, the quantity of work, requisite for effecting a given change in the dynamic equilibrium of the whole circulatory system, is proportionately greater, the more considerable (if we may be pardoned this much too indefinite expression) in quantity and quality this change is, . . . the following general rule can be established. The smaller the mass and therefore the nervo-motive force of a specific accumulator, so much the more closely is its discharge dependent upon the condition that the whole dynamic system, above all and very especially in the immediate neighborhood of the accumulator, find itself again in exactly the same circumstances in which it was when the accumulator was formed. Conversely, the greater the mass of the accumulator, the more easily can the conditions obtain which are able to effect its discharge." Consequently, if the mass, and hence the nervo-motive force of the accumulator, be minimal, it will be able to discharge only when the whole dynamic system in the immediate en-

vironment comes again into the same conditions practically as existed when the accumulator was formed.

"Let us suppose, further, that as the result of external influences there are induced at the same moment at a few points of the system a corresponding and equal number of new nerve-currents, specifically different from the preceding, so that the system is thereby caused to pass over to another dynamic equilibrium. It is clear that there will then be deposited in each point of the system—and not merely in those which external influences have directly modified,—a new specific potential element, in mass more or less large according to the time which the new state of dynamic equilibrium persists. At the same time, however, all these same points of the system will preserve, in a potential state—not in activation—, all the specific elements which were deposited during the preceding state of dynamic equilibrium.

"If, such being the state of things, it now happen that even any single point whatever of the system is brought back again, by any external influence, to the specificity which it already had possessed in the preceding stage, that will make it possible for the respective specific elements corresponding to that stage to come again into activity, at first in the point nearest, and then from next to next until in the most distant; for then each of these elements will find its immediate environs in approximately the same conditions as when that element was deposited and in activity. It will suffice then that even a single point of a system return, through the action of external influences, to its preceding state, in order that the whole system, transforming itself during the discharge of the different specific potential elements corresponding to that former stage, should resume the whole dynamic condition of that stage.

"We have then a phenomenon of succession or of asso-



ciation of nerve-currents which, as is easily conceivable and becomes even clearer later, may serve as a basis for the psychic law of succession or association of ideas."

This quality in nervous accumulators would explain how memories are recalled by association, how the memory of one part of a scene recalls the other parts, one after another, and how the memory of an event develops in our minds in the same sequence as was originally followed by the different parts of the event itself.

This specific potential mnemonic element or elementary nervous accumulator is "according to the hypothesis nothing else than the minute particle of a substance which each new specific nervous current, passing through a nucleus deposits in it, a substance which adds itself to those already present in it without changing them and which is capable as soon as it finds itself in the same relation to its environment as at the time of its deposit, of restoring the same specific current by which it was produced." On pages 345-354 the author continues:

"The above-mentioned conception of Hering of the disposition of the nervous substance to sound again the tone of yesterday is derived from the physical phenomenon of acoustic resonators. The nervous substance which would be made to vibrate in a given specific way at a given point by a definite elementary sensation or representation would remain from that moment capable of vibrating always and exclusively according to that specific mode. According to the hypothesis of mnemonic elements on the contrary, it is well to repeat again each elementary sensation or representation would consist not so much in a specific vibration of the nervous substance at this or that point but in the production by the action of external stimuli of a given specific nervous current. In this way the memory of an elementary sensation or representation would consist only



in the reproduction by the action of causes now internal of the same specific nervous current.

"In other words the way in which the hypothesis of mnemonic elements or specific elementary accumulators would conceive of the mnemonic phenomena is as follows:

"A series of sounds or of words, for example a certain melody, or some phrase of a discourse when once it has entered by the ear we can imagine, produces a series of nervous currents in the auditory nerve specifically different one from another just as in a telephone the successive electric currents are specifically different from one another (in this particular case different in intensity) which the same series of sounds produces in the receptive apparatus and later transmits along the wire. If then one or several nerve centers, after receiving these specifically different currents, are capable of storing up these specific energies, each distinct from the other in such a way as to reproduce them identically later at the moment of discharge, and if, further, the discharge of each immediately preceding specific energy and it alone is capable of producing the liberation of the specific energy immediately following (and we have seen above that this is one consequence of the hypothesis of specific elementary accumulators), it will be in this way possible for the same succession of different specific currents and consequently of different ideas or impressions to be repeated a great number of times, and it is in just this that the mnemonic phenomenon consists.

"One could evidently say the same thing of the optic phenomenon, that is to say, of any series of colors or specific luminous vibrations which succeed one another in space or time.

"Ribot has rightly said that 'There is not one memory, but memories; that there is not one seat of memory, but particular seats for each particular memory.'<sup>5</sup> And, ac-

<sup>5</sup> Ribot, *Les maladies de la mémoire*. Paris, Alcan, 1901, p. 11.

cording to this theory, each mnemonic element would constitute a particular seat for each elementary sensation or each particular specific impression.

"In this sense also, that is to say on the condition that the expression 'nervous elements' be not disjoined from the conception of elementary specific accumulators or mnemonic elements, we can accept the idea of memory which this investigator (Ribot) has put forward: 'If we attempt,' writes he, 'to recall a good memory and to express this in physiological terms, we must figure to ourselves a great number of nervous elements, each modified in a particular manner, each taking part in one combination and probably capable of entering into several, each of these combinations containing within it the conditions of existence of the states of consciousness. Memory has then static and dynamic bases. Its strength is in relation to their number and stability.'<sup>6</sup>

"'One asks,' continues Ribot, 'if each nerve cell can preserve several different modifications or if once modified it is forever polarized. The number of cerebral cells being about 600,000,000 according to the calculations of Meynert (and Sir Lionel Beale gives a much higher figure) the hypothesis of a single impression is not inconceivable.'<sup>7</sup> It may be remarked here that according to the hypothesis of mnemonic elements there is room in each brain cell for a whole series of specific deposits and not merely for one specific deposit. . . .

"Provisionally it can be affirmed that the close dependence of memory upon the nutritive processes<sup>8</sup> indicates strongly that the preservation of memories is to be ascribed to accumulations of substances. Further, as was very well remarked by Hensen, the fact that many memories through-

<sup>6</sup> Ribot, *loc. cit.*, p. 32.

<sup>7</sup> Ribot, *loc. cit.*, p. 17.

<sup>8</sup> Ribot, *loc. cit.*, pp. 155-163.

out several years may remain completely quiescent and then can come again with great distinctness into consciousness, notwithstanding that all the parts of the organism have been renewed several times in the interval,<sup>9</sup> indicates (if one recollects that assimilation consists in the incessant reproduction of new masses, always of identically the same substance) that in order to preserve these memories it is sufficient if for one given substance there be substituted another identical one. The existence finally of several more or less clear, more or less intense memories, coupled with the fact that this greater clearness or intensity and all hypermnesia in general depend also upon phenomena of nutrition, indicate that the degree of vividness or intensity and the degree of hypermnesia in general may be a function of the mass of the substance concerned, on the accumulation of which the preservation of these memories is dependent.

"If it appears thus to be shown by facts, that the preservation of memories is due to accumulations of substance, a whole series of other facts seems to demonstrate that the reawakening of these memories consists in the restitution of the same currents as had formerly constituted the actual sensation or impression.

"We need not recall here all the innumerable examples which show that the motor or secretory or physiological effects in general of the mnemonic reawakening of a given sensation or impression are quite identical with those of the real sensation or impression: for example, the recollection of a certain dish produces the same salivation as is provoked by the dish itself; the memory of the beloved person can cause each time the same reddening of the countenance, the same brightening of the eyes, the same acceleration of the pulse as the direct view of that person; every

<sup>9</sup>Hensen, *Ueber das Gedächtnis*. Kiel, Universitäts-Buchhandlung, 1877, p. 13.

time that a mother thinks of her nursing child there comes a flow of milk into the breasts. These are some examples which show the substantial identity of the functional and mnemonic stimulus. . . .

"If the preservation of each memory is due to deposits in number exactly equal to the specific elementary nervous currents which the sensation or complex impression had provoked in the nervous system, we are then in a position to comprehend also the phenomenon known under the name of abridgment: 'Every memory,' says Ribot, 'however limited it may be, undergoes an enormous abridgment. The farther that the present recedes into the past, the more do the conditions of consciousness diminish and disappear. Reviewed at several days distance there remains little or nothing of them; for the most part they have darkened into a nothingness from which they will never again emerge and have taken with them the time duration inherent in them. Consequently a diminution of the conditions of consciousness is a diminution in time.'<sup>10</sup>

"This disappearance of the elementary conditions of consciousness producing the abbreviation of the memory will be due, then, according to our view, to the disappearance of the secondary mnemonic elements, that is to say, those provided with a minimum quantity of the respective substance (and potential energy which is the consequence of it) from the series which constitutes the entire memory. Possibly this disappearance can be caused by the fact that the nutritive fluid has come gradually to be entirely absorbed by the principal mnemonic elements of the same series and by the new elements which later supervene as a consequence of later sensations also stored up in memory. . . .

"In recalling a given memory the cells do not lose the 'impression,' as we call it, which they preserve of that mem-

<sup>10</sup> Ribot, *Les maladies de la mémoire*, pp. 44, 45.

ory; on the contrary, the more a memory is recalled, the more the respective 'impression' is reinforced. This signifies that the entrance into activity or function of mnemonic elements merely causes their mass and their potential energy to increase. . . . The active participation of the mnemonic centers in the biological phenomena of memory leaves them in the same state as before so that they are equally capable and even more capable than formerly of reproducing many more times the same phenomena.

"The reawakening of mnemonic centers at long intervals of years constitute very ordinary phenomena. Cases are frequent, for example, of adults who are able to repeat poems which they had learned in their earliest childhood, even after many years during which they have never had occasion to repeat them at any time. Coleridge speaks of a young girl who in the delirium of fever, repeated long fragments in the Hebrew tongue which she did not understand but which she had a very long time before heard read aloud by a priest in whose service she had been.<sup>11</sup> A Lutheran preacher of German origin living in America, who had in his congregation a considerable number of Germans and Swedes, related to Dr. Rush that nearly all, a little before dying, pray in their mother tongue. "I have," said he, "innumerable examples of it, and among them several in which I am sure they had not spoken German or Swedish for fifty or sixty years."<sup>12</sup> Rignano cites other similar instances, but in this review it is not expedient to multiply them. Such instances are familiar to every one. He continues:

"These examples show, then, how remarkable can be the persistence of conditions latent in memory. Let us note further, that these last cases present, in a very striking

<sup>11</sup> Maudsley, *The Physiology of Mind*, p. 25.

<sup>12</sup> Ribot, *Les maladies de la mémoire*, pp. 146-147.

form, what Ribot calls 'reminiscence from contiguity in space'.

"These reminiscences through contiguity in space are only a particular case of the general law of the association or succession of ideas. They indicate that the mnemonic center reacts only when the sight of the same place induces in the environment of that center almost the same state of nervous distribution as at the former time when it received the impression. That is exactly. . . . the result to which we were led by the hypothesis of specific elementary accumulators which have advanced."

Having seen thus how the faculty of memory finds an explanation in this simple hypothesis and how certain corollaries following logically upon its acceptance explain the various qualities of mnemonic phenomena, it remains to see in what way the fundamental process, which is suggested as the basis of memory, is inherent also in other vital processes. If it be true that currents of nervous nature, able to deposit these accumulator substances, are not confined to the nervous tissues proper, but pass constantly through the cytoplasm of all living cells whatever, to and from the nuclei, we have thus provided a mechanism whereby mnemonic faculties can be exhibited, by every part of living organisms. There is very good evidence that such currents do exist. Pfeffer demonstrated the presence in plants of nuclear excitations which passed through the cytoplasm and produced specific effects at the distance of several millimeters.<sup>13</sup> Commenting on Pfeffer's experiment, O. Hertwig states that "it is thereby proved that the stimulus necessary for membrane formation can be transmitted through the fine connecting filaments which pass through the dividing wall between two cells. There is nothing in the way of admitting similar means for the transmis-

<sup>13</sup> Pfeffer, "Ueber den Einfluss des Zellkerns auf die Bildung der Zellohaut," *Berichte über die Verhandlungen der königl. sächs. Gesellsch. d. Wissensch. zu Leipzig*, 1897, p. 507.

sion of other functional stimuli also."—"It is probable that the transmission of nuclear stimuli by protoplasmic filaments is much less rapid and less intense than nerve conduction, but perhaps for this very reason may be more continuous and by reason of its duration more efficacious."<sup>14</sup> All the phenomena of nervous nature exhibited by protozoa and low forms of animal life must depend upon similar nervous currents. While the higher animal organisms are still in an embryonic state, and before a nervous system is developed, such simple means of transmission of impulses by means of cytoplasm, protoplasmic filaments and intercellular bridges must be the only ones available. During the development of the nervous tissues proper, there must be co-operation of the two methods, as also in the adult organism in which there would thus be provided a general nervous circulation whereby the entire organism is connected up, both adjacent and remote parts into a single plexus.

The mechanism necessary for the general exercise of a mnemonic faculty being present throughout the organism, it is interesting to note that Hering finds the mnemonic faculty itself present, as shown in his book *Ueber das Gedächtnis als eine allgemeine Funktion der organisierten Materie*, pp. 16-17. Hering's assertion has recently been taken up again by Richard Semon, and more thoroughly and completely treated in his work, *Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens* (Leipsic, Engelmann, 1904). Ribot also states that "memory is essentially a biological fact, accidentally a psychological one."<sup>15</sup>

The possession by living matter in general of a mnemonic faculty should throw some light upon many of its activities and especially upon those which resemble mem-

<sup>14</sup> Oscar Hertwig, *Die Zelle und die Gewebe*, II, pp. 40-41.

<sup>15</sup> Ribot, *Les maladies de la mémoire*, p. 1.



ory. All those phenomena which show a restitution of a vital process, or a repetition of it many times, and always in the same way would find an explanation in this faculty. In this connection one thinks at once of the germ substance which in successive ontogeneses repeats a vital process, and tends to repeat it always in exactly the same way.

(Rignano, pp. 339-340): "The comparison between the phenomena of development and the phenomena of memory, especially after the discovery of the fundamental biogenetic law, that the ontogeny of each individual tends to repeat exactly the ontogenies of all its ancestors, has presented itself spontaneously to a large number of authors. 'The germ,' wrote Claude Bernard, 'seems to preserve the memory of the organism from which it proceeds.'<sup>18</sup> Haeckel attributes development to the mnemonic quality of his plastidules. . . . Orr endeavored to explain recapitulation during ontogeny by the mnemonic law of habit. Cope held that ontogeny is called forth by the unconscious memory of phylogeny. Naegeli and, in some places, Hertwig, himself, attributes to the idioplasm the faculty of remembering, so to speak, the successive phylogenetic stages through which it had gradually passed.

"But it was above all Hering who maintained most boldly the fundamental identity of the ontogenetic and mnemonic phenomena: 'What is it that causes this reappearance in the daughter organism which is developing, of characters of the parent organism if it be not a reproduction on the part of organized matter, of processes in which it has already taken part at another time, if only as a germ in the ovary; and which now at an opportune moment it recalls exactly while reacting to the same or similar stimuli in a manner similar to that which the preceding organism has already followed, of which it was formerly a part and

<sup>18</sup> Claude Bernard, *Leçons sur les phénomènes de la vie communs aux animaux et aux végétaux*, p. 66.



of the vicissitudes of which it had then shared? If the parent organism by long custom or repeated action has changed somewhat in nature in such a way that the germinal cellule within it has also been affected, however feebly it may be, and if this latter commences a new existence growing and developing into a new being of which the different parts are not other than itself and flesh of its flesh, and if in thus developing it reproduce that which it had already experienced at another time as part of a great whole, this is also precisely as astonishing as when memories of his early childhood are recalled suddenly to the old man, but it is not more astonishing. And whether it may be still just the same organized substance which reproduces a process already once experienced, or whether it may be only a descendant, a portion of its substance which in the interval has grown and become large, this is manifestly a difference of degree only and not of essence.<sup>17</sup> The observation of the similarity of the two processes, although extremely interesting, so long as neither phenomenon was understood, did not help science much in its search for the fundamental causes. Rignano remarks (pp. 341-342) that "this extension of the mnemonic faculty over every vital phenomenon without exception, [including development] although it contains much truth, could not by itself constitute any explanation of either one phenomenon or the other, but on the other hand helps to plunge both into deeper darkness; for while by this comparison the obscure fundamental peculiarities common to both become in no wise clearer, the most striking characteristics of each of the two phenomena which are different in the two, and which are those that up to the present have served to give us the most exact ideas possible of their respective phenomena are left out of consideration.

<sup>17</sup> Ewald Hering, *Ueber das Gedächtnis als eine allgemeine Function der organisierten Materie*, pp. 16-17.

"The phenomenon of memory can serve neither as an explanation of the phenomenon of development nor of the vital phenomenon in general, because it constitutes itself a phenomenon more special and more complex than those it was summoned to explain. There was still, however, a possibility that the resemblance which appeared to exist between some essential characters of these three phenomena might be explained by a fourth more general and more simple phenomenon, which would be at the same time the basis of all three categories of phenomena; the ontogenetic, mnemonic properly so called (psycho-mnemonic), and the vital."

This hypothesis of specific nervous accumulators constituting germinal, mnemonic, and vital elements affords an intelligible explanation of that basic property which would explain and unify all three.

#### EXPLANATION OF ONTOGENY.

In his biogenetic law Haeckel formulated the marvelous phenomenon of recapitulation of phylogeny during ontogeny. During the course of ontogeny the developing organism tends to repeat the development of its ancestors, one after another, passing from stage to stage in the order in which those stages appeared in evolution. Thus even though modifications may supervene, it can be said that at each stage it represents the form of an ancestor which attained at that stage its full development. From the beginning of development the same stages follow one another in the same order in all animals in so far as they have a common line of descent. Some influences come into activity within the embryo serially, causing it to pass from each stage to that following next in the oft repeated series. This principle of repetition in embryological development, although so familiar, is yet inexplicable. So far there has

been no satisfactory explanation of what the impelling forces are, nor of why developmental stages should succeed one another always in the same order recapitulating phylogeny.

But the phenomena become intelligible if with Rignano we consider the germ substance as constituted by specific, mnemonic, germinal, elements quite like the specific mnemonic elements of the brain substance. Just as stimuli acting upon human bodies, in addition to bringing about physiological changes and sensations cause also the deposit in the brain of corresponding specific accumulators (as we have already noted in our consideration of memory), so also the stimuli, whatever they may have been, which acted upon the germs of the ancestors of organisms now living, in addition to bringing about developmental changes would also cause the deposit in the germ of corresponding specific accumulators. Just as the specific mnemonic accumulators in the brain cells are able, when conditions permit their activation, to cause former stimuli (nerve currents) to be reproduced capable of causing a repetition of the same sensations and physiological changes, so also the specific mnemonic accumulators in the germ substance would be able when conditions permitted their activation to cause former stimuli to be reproduced capable of causing a repetition of the same developmental changes. And this repetition will be effected during the development of organisms of later generations.

There is thus suggested a working hypothesis by which we can understand what the impelling forces of development may be and whence they come. It remains to be explained why developmental stages should succeed one another always in the same order recapitulating phylogeny.

In memory there operates the law of association of ideas and we have seen this to be dependent upon properties which specific, mnemonic accumulators must pos-

sess in accordance with the general physical laws to which they are subject.

If we admit the general rule then developed for specific accumulators, by which (pp. 315-316) "the quantity of work requisite for effecting a given change in the dynamic equilibrium of the whole circulatory system, is proportionally greater, the more considerable in quantity and quality the change is, it becomes at once conceivable why each specific potential element of the germinal centers can become activated only when the embryo has reached the ontogenetic stage, corresponding to the particular phylogenetic stage, at which this element had been acquired by the germinal substance. For then first will the change which the dynamic system of the embryo undergoes, as a result of the activation of this specific potential element, be the least possible, and therefore generally also the only one whose resistance can be surmounted by the very weak nervomotive force of this specific potential element." Therefore these accumulators must become activated one after another, always in the same order, and always in the order in which the corresponding stimuli had become operative in phylogeny. We thus have provided a mechanism which, acting with all the certainty of a physical process, must tend to cause developing organisms, in so far as they have common ancestors, to pass in the same order through the same series of changes, namely those through which their common ancestors passed in evolution. And this arrangement is the same as that which causes recollections of successive events to come up, according to the mnemonic law of association of ideas, in the same order as that in which the events themselves had originally occurred.

(P. 354) "In mnemonic phenomena proper [psychic], they are the infinitely diverse and constantly changing conditions of the external environment, and the corresponding sensations following in the individual which call forth like

a phantasy such and such an association or succession of ideas. But in the development of the embryo which is removed from the action of every external perturbing influence and above all, which is provoked by the activation of different specific germinal elements from one and the same complex mnemonic center constituted by the germinal substance, the succession of mnemonic states of this latter called into activity one after the other, and of the corresponding stages of ontogeny must inevitably proceed in uninterrupted series, always the same for all individual ontogenies of the same species. For to reawaken each mnemonic element of this germinal substance there must again concur exactly the corresponding conditions of nervous distribution of the embryo which had been provoked by the re-awakening of the mnemonic element immediately preceding.

"It is then in development even more than in mnemonic phenomena properly so called that there operates the law of rigorous succession, in which, as Ribot says, each member of a series produces the following."<sup>18</sup>

Just as there is abridgment of every memory, so there is also abridgment in the recapitulation of ontogeny by phylogeny. (P. 351) "In fact of the older mnemonic elements constituting the germinal substance, the strongest, that is those which are represented by the largest quantity of substance, alone persist. The less strong older mnemonic elements, the total quantity of nourishment for all mnemonic elements remaining the same, or varying only within definite limits, will have all their portion of nourishment taken away by the strong older mnemonic elements and by the newer mnemonic elements whose number will continually increase with each phylogenetic advancement. Not being able consequently to regain their substance completely in each ontogenesis, they will gradually disappear."

<sup>18</sup> Ribot, *Les maladies de la mémoire*, p. 8.

Thus ontogeny becomes not a full but only an abridged recapitulation of phylogeny.

Further, just as in memory the time factor is eliminated, so in ontogeny, the specific germinal accumulators become activated as soon as the conditions permit and the organism in its development runs through in a few days a series of changes, which may have required thousands of years in phylogeny. Just as in memory specific mnemonic elements may become activated only after intervals almost life-long, so the specific germinal elements will become activated only in the ontogeneses of successive generations. Just as in memory, reminiscence does not exhaust the mnemonic elements, but strengthens them, so in ontogenesis the repeated development of characters fixes them in the germinal substance, and palingenetic characters are more firmly stamped upon the race than cenogenetic.

In this hypothesis of specific germinal and mnemonic elements, accumulators each of a corresponding specific nervous influence, Rignano has suggested a common basis for the phenomena of memory and ontogeny, which explains both these processes and unifies them. In affording such an intelligible explanation, the hypothesis stands alone, for while these phenomena have been among those most studied, they remain among the most marvelous in biology, or perhaps in the whole field of human knowledge. No satisfactory explanation has even been suggested heretofore, and such a conception of them as Rignano's, explaining them in terms of physico-chemical laws already known, will be welcomed and carefully considered by all biologists whose work has led them to feel the need of such explanations and to the conviction that they must rest upon a physico-chemical basis.

The many observations which have been made, of the resemblance between mnemonic reproductions of the likeness of former things, and the reproduction in an embryo

of the likeness of its ancestors, which heretofore have been vague and misty, become in the light of this conception vastly more interesting, and become also vastly more significant and valuable to science in its search into their essential character and into the nature of the vital process itself.

(P. 355) "In summing up all that we have said thus far we can thus affirm that if the mnemonic phenomena, properly so called, can not serve to explain ontogenetic phenomena nor the latter to explain the former, the resemblance which has nevertheless been noted by so great a number of authors can be explained by a third phenomenon more general and more simple than either. And this phenomenon consists in the faculty possessed by all living substance of accumulating and repeating individually different particular specificities of generic nervous energy, and this constitutes the essence of all vital phenomena whatever."

The question of the transmission of acquired characters is treated in the book at considerable length, the author regarding it as of the greatest interest and importance. He states that in his earlier studies he was inclined to reject the Lamarckian theory largely because there was no conceivable mechanism available for an explanation of transmissibility.

But in this hypothesis he sees a way by which functional stimuli which bring about somatic modifications may bring about corresponding modifications of the germinal substance also, understanding by the term functional stimuli of course the stimuli set into operation within the organism, and not the external action of the environmental stimuli which provoke them.

For if the stimuli which during phylogeny cause the acquirement by a species of new characters are produced in the individual organisms as a result of the action of external environmental stimuli, then this hypothesis affords



an explanation of how they may be transmitted to the germinal substance, for such stimuli passing throughout the entire organism, which as we have seen is one vast plexus, not only cause in some parts the development of new characters, but also cause the deposit of corresponding specific accumulators in many cells, the germ cells among others. Those deposited in somatic cells will disappear with the death of the individual, but those in the germ cell, will be in a position to effect the continuation of the new character in the species, if they have been deposited in considerable mass, as a result of the action for a long time of a persistent new environmental stimulus. For such accumulators, becoming activated when the development of the organism which they produce has reached the stage, corresponding to that at which the new character was acquired in phylogeny, will cause the same morphogenic stimuli to be discharged, which acting upon the developing organism will at once cause it also to develop the new character.

Other phenomena, such as atavism, reversion in hybrids, sexual dimorphism and polymorphism are taken up, but it must suffice here merely to refer to the book for a consideration of them. Manifestations of these properties by living organisms is shown to be quite in conformity with the hypothesis he has advanced, and to find in it some explanation. The author continues (p. 356):

"It remains for us to demonstrate that this property as we have affirmed before, can aid us in great part to explain the essential characteristics of the vital phenomenon itself in all its generality—that is assimilation."

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[TO BE CONTINUED.]



## HAS THE PSYCHOLOGICAL LABORATORY PROVED HELPFUL?<sup>1</sup>

THIS is a question stated in such a way that many people will find in its very statement a negative reply. But my intention here and now is to put a question without giving the answer, to state a problem without solving it. It is something indeed to state the question. Were I to give an answer it would demand more time than I would be justified in consuming. I will not give the external history of the laboratories; this would avail us less than one might think. My task is more modest or more pretentious as you prefer; I confine myself to mental impressions, which, nevertheless, can bring us nearer to the truth than history. How many times an institution conceived and established in a certain spirit ends by working in a different spirit to serve still another spirit.

A psychological laboratory!—I do not know what there is in the shop, but it must be admitted that it could not have a droller sign. You may say I am jesting but there is no other way to interpret the expression than somewhat after this fashion: Here ideas are manufactured, volition is distilled, sentiment is created. So it seems that even the intent and the conception of a psychological laboratory must be the result of a misapprehension and at the service of this misapprehension; it seems that philosophy has noth-

<sup>1</sup> Address delivered on September 4, 1908, before the Third International Congress of Philosophy at Heidelberg; translated from the French manuscript of Professor Billia by Lydia G. Robinson.

ing to do but to refrain from taking interest in it, or perhaps to enter just once in order to administer charitable advice and to give the savants in charge of the laboratories a little instruction in modesty and prudence by making them see how vain and deceptive is the pretense at studying and knowing the facts of consciousness outside of consciousness, and how greatly one is deceived by the most pitiful illusion when he imagines that what he measures, what he pulls and pushes, what he weighs, and what he analyzes by the aid of material things is really consciousness, thought, sensation.

But in this task of removing a misconception, we soon meet with a difficulty which proves a hindrance; or, rather, restrains us for the time being and makes us consider the matter once more. We are not overawed by the insolence of those who appear to work for the purpose of reducing the facts of consciousness to the measurement of material facts; on the contrary what has detained us is the good faith, the serious spirit and the useful contributions of others who are true experimenters. With what right are we to teach modesty to modest men, logic and the limits of experimental research to those who pursue the study of its logic and are well aware of its limits? When we step into the laboratories of the Claparedes, of the Flournoys, of the De Sarlos, of the Kiesows (I can not undertake to make the list complete) we find ourselves face to face with men who tell us without any reservation that they are in search of facts only, that they do not work in behalf of a system or a party but for the single purpose of contributing to the knowledge of mental facts. These are the men who do not wait for our reservations to assure us that they have never pretended to tell us what sensation is or what thought is, nor whence they originate, but only to determine some conditions of the nervous system, or the organism, and even of the environment in which the

facts of consciousness are produced in such and such a way, and even when they are produced or when not. This has impressed us; it has disarmed us; it has instructed us.

Further, truth has nothing to fear from truths. We have readily understood that this serious study of the external and physiological conditions of the facts of the soul would have brought us at the same time to a better recognition of these facts and to the clearer and clearer distinction between these facts and their permanent conscious and individual principle on one side, and on the other of the somatic conditions in which they manifest themselves.

Finally, there is no other point in question than to be able some day to give an exact solution to this correspondence of each different instant which obtains in the consciousness of every person. Formerly I tried to reduce this correspondence mainly to a limitation of the power of reflection,<sup>2</sup> which becomes manifest in the consciousness even of philosophers at certain hours of the day when in a state of fatigue, exhaustion or intoxication, and which indeed may be the condition of the whole life of certain unfortunates whom we call fools, simple minded, and idiots. If this solution could be reached how many problems would be solved! There would then be some hope of carrying out the old well-known and very audacious assertion of Descartes that medicine would one day be able to govern the mind and the character; that is to say, to deliver humanity from evil and disorder. Education would no longer have to struggle continually against difficulties and recurring deceptions, because it would know in advance what might be expected of each individual under definite conditions.

This is a matter of which we have had some idea for a long time. We might even find precursors of psycho-phys-

<sup>2</sup> *Lezioni di Filosofia della morale*, VII. Rome, Torino, 1897. Ernest Naville e il libero arbitrio. Rome, Torino, 1900.

ics in the greatest metaphysicians of earlier days. An investigation which I myself have made with the intention of proving that the great metaphysicians were also great masters of observation, has led me to discover an advanced psycho-physics not only in Rosmini who is too modern to prove my point, but in Malebranche and even in Plato.<sup>3</sup> That which was then still lacking and could not be expected until the science of to-day and of the future, was measurement and exact determination. The nearer we approach to this measurement and exact determination, the more we see that it by no means supplants the idea of the mind and of its action upon itself, not even pretending to explain its production, its origin and nature; but only to establish limits and conditions, in such a way that even if the laboratory was established for materialistic purposes its triumphs and its most serious results have been in the service of spiritualism. As my friend M. Adrien Naville has said: "It will always be understood more clearly in proportion as the physiology of the brain progresses. Anthropological monism can only live in the twilight. When physiologists shall have succeeded in expressing in definite mechanical formulas the movements of the cerebral cells which are analogous to facts of consciousness, no one can insist that these facts of consciousness are the same thing as a movement."<sup>4</sup>

The evident conclusion from all these observations and all these considerations will therefore be that psychological laboratories are the more useful and conspicuous an aid to the study of the mind according as the expectations of the scholars who looked forward to them are more modest, and the results more precise, definite, determined, positive.

But there is a train of ideas which carries us along in

<sup>3</sup> *Delle dottrine psicofisiche di Platone*, Modena, 1898; *Esti. d. Atti d. Accademia. Delle dottrine psicofisiche di Nicolò Malebranche*, Berlin, 1900. *L'esigilio di S. Agostino*, Turin, 1898.

<sup>4</sup> *Revue Scientifique*, Mar. 5, 1887, p. 316.

spite of ourselves. We have seen that the psychological laboratory has carried the materialist and the positivist in the direction of spiritualism. But whither is the spiritualist led who, disarmed by the modest and earnest bearing of his ancient adversary, enters into the laboratory, shuts himself up, and abandons himself to the confident expectation of finding there a more exact confirmation of all the truths of his consciousness and one more suitable for persuading others?

I. In proportion as he acquires a more precise, more exact, more definite knowledge of physiological, and even of physical and chemical conditions, in which and under which such a fact of sensation, of thought, and of will is produced, he runs the risk of losing the clear vision of what this fact truly is; very much as those literary critics who are better informed about the exact day and hour of Dante's birth and the exact spot in Florence where his house stood and about the gate of the town from which he departed to take his flight in exile, are not always the ones who best penetrate into the spirit of the loftiest of poets. By seeing that a phenomenon occurs under such circumstances, one is led to believe that it has not occurred and does not now occur except under such circumstances; and with this we have now come back to the prodigious misapprehension of a fact of consciousness studied outside of consciousness. In other words, in spite of the best intentions to the contrary, psychology itself is destroyed by the psychological laboratory.

II. Again, the experiments in the laboratory give us such a habit of considering and measuring the limitations of our power of feeling, of understanding, and of willing, that they lead us to forget another side of our psychical life which is no less a true side, namely liberty, and the power of passing beyond those very limits, and of extending our faculty of feeling, understanding and of willing

still farther beyond. Certainly to find an exact determination of the physiological and physical limits of our intellectual and volitional operations appears to be a great triumph, but in the first place who said that this determination would be the same for all? or that it always results in the simple combination, that *a* being given as the sum-total of physiological conditions we will have *b* for the sum-total of psychical conditions and that each change which takes place in *a* leads necessarily to the same change in *b*? This indeed would be a most comfortable and alluring theory, but here is where consciousness will have to do with facts which throw a great suspicion of doubt upon this formulation. Psycho-physical correspondence<sup>5</sup> is not at all constant. I am not a pragmatist not a Bergsonian. I do not say that it defies all rule, all possible determination, I simply say, and I insist upon it, that it is not confined within the limits of the determination furnished by the laboratories or through the laboratory method. For instance, it is easy to admit that during the day in the ordinary life of a healthy person with a good constitution, and still more during the day and in the ordinary life of a person somewhat delicate and ailing, there is a physiological limit beyond which he loses the power of reflecting which should operate in two processes becoming more and more painful and finally unbearable; viz., the effort to pay attention to a long and complicated series of ideas, of symbols, and of images, or of circumstances which compel a decision to be made; and the effort to fix one's mind for a long time upon the motives which persuade us to endure to the end something requiring great patience. For instance, you all agree in admitting that you could not endure the tiresomeness of my discourse for three hours, and, for my part, I could not endure certain noises for a few consecutive minutes

\* Those who do me the honor to grasp my thought will have to content themselves with the word correspondence. Identity would indicate too much and parallelism too little.

without being greatly disturbed. They say, or at least we are constantly besought to have the decency to believe, that the learned physiologists have determined by exact measurement the intoxication of nerve centers, the exhaustion of nervous and muscular force, the breaking down of tissues, especially in the brain, which corresponds to the mental relaxation as its only cause.

But right at this point, if many facts seem to justify these conclusions, other facts, less numerous to be sure but well established and authenticated, give the lie to the pretensions of those who would measure exhaustion if they try to give the results of their experiments as an absolute and universal law. If a tyrant were to make my lecture last four hours the rest of you though reduced to extreme exhaustion would still be able to give your attention to a soothing melody which some solacing spirit might cause to resound and even to a homelier fanfare from the street. However, it is a fact of almost elementary physiology that because of the multiplicity of vibrations the nervous fatigue of a man who listens to the best of concerts is far greater and far more exhausting than that of him who listens to the dullest of lectures.

Soldiers who faint from thirst and fatigue and are no longer conscious of their surroundings will throw themselves once more into the assault if they are made to believe that victory is sure or that their safety rests on the condition of one supreme effort. Those who, like myself for instance, have a very delicate nervous system often experience moments of such exhaustion that they require absolute and immediate relaxation and repose. There must not be the slightest delay for this recuperation, no noise, nor any effort of attention. Now if under these conditions we come home and find that some member of the family has suddenly been taken ill, that a child is in danger, that the daily paper has given a false report prejudicial to our



scientific or political reputation or to our party, and that its refutation cannot be postponed later than the edition of the following morning, we are at once ourselves again, we summon our forces, our attention, and we postpone our fatigue, dismissing all thought of supper and bedtime.

It is true that we have reserve force, but this only succeeds in deferring the difficulty. It is according to our discretion that we draw upon these reserves, therefore the limit is not absolute,—or if there is an absolute limit it is not the physiological limit; or if it is always a physiological limit it is not the one which the laboratories determine or are able to determine.

Please consider once more that this extension and widening of limits which takes place suddenly in the presence of a motive may in certain individuals indeed become a constant exercise, the limits to be extended day by day, and powers of feeling, thinking, and willing to be indefinitely increased. The laboratories teach us these limits. Consciousness here confronts us with a great mystery; where are the limits? As soon as the limit of one instant can be removed to the instant after and so on, is there still another limit in this power of extending the limit? I state the question but I do not expect it to be answered. I have only to say that this is the great question of psychology; I have only to say that the laboratory which forgets it, in so doing destroys psychology.

To be sure, to give us an idea of limits which is perhaps instructive and wholesome, may render us more discerning towards ourselves and towards others, may give us the wisdom to avoid claiming the impossible. But the habit of always taking physiological limits into consideration may also stifle the consciousness of our inner powers, the consciousness of the power of the mind acting with an ideal in view. More discerning alas! But it has also given us a cowardly habit of considering certain disorders such



as debauchery, drunkenness, slavery, war, and capital punishment, as if they were determined by external and organic conditions, and to forget the agency of liberty and its power in degenerating as well as in upbuilding,—agency and power which are no less positive facts than all the physiological determinations, and moreover are themselves the determining factors.

III. Finally, the psychological laboratory leads us to treat mental facts as external objects of experimental research and curiosity. But mental facts are not that. The mind which we observe is nothing else than we ourselves who live and ought to exist in a certain manner. The question is not to see how some one or some thing operates. The important thing is that we ourselves should always be and do well,—always better. There are experiments which should not be performed because they injure us, deteriorate us, remove us farther from perfection. Only those experiments should be performed which in themselves are a step in our development. Not all curiosity should be satisfied because its satisfaction is at our expense, because it is on ourselves that the experiment is made.

A bigoted man of science may challenge me with the scandalized question: Would you found education upon ignorance? Not at all; it would be offensive to say and absurd to think. But it is well to have the courage to state clearly that some ignorance is an indispensable element of education. Why? Precisely because at bottom human education is in no way possible unless it is founded on science, which is at the same time both the means and the end of education. Now some ignorance is the indispensable condition of all knowledge. I may know all the gossip of the town, yet I will be very ignorant not *in spite* of this, but *on account* of it. You are scholars not only because of the attention you have given, but also because of that

denied. Whoever wishes to acquire a practical acquaintance with the sights and especially the sensations, of cruelty and debauchery, must condemn himself to ignorance of decent and charitable feelings, or at least of the noblest sentiments of mankind; and *vice versa*, he who would acquire a true, faithful and complete knowledge of these must needs renounce forever not only the practice of the wrong things but knowledge of them as well. Still considering the lack of a system and the brevity of life and other hindrances to vast knowledge, it is by no means impossible to form a truly cultivated mind without sacrificing a great deal of detailed and encumbering erudition and without yielding either to the many particulars of that form of presumptuous ignorance which is called *specialism*, or to a large part of the medley of the other form which may be called encyclopedic. We owe the greatest portion of our knowledge to books that we have read; but much also to our good fortune in having escaped reading many others.

My position with regard to these observations is that of a *φιλομαθής* but not a partisan; consequently I like to consider the matter in all its aspects. I have often thought of one thing which seems to contradict my conclusions. A large part of the studies of physicians accustom the young men to a familiarity with sights which on account of their nature and circumstances are by no means apt to cultivate respect and delicacy of feeling. Nevertheless being acquainted with many physicians I have no right nor inclination to participate in the unfavorable opinion of them professed by Jean Jacques Rousseau—although otherwise he was so compassionate in his writings; for I have observed it to be an undeniable fact in the case of many physicians and surgeons that they have preserved and cultivated as delicate, tender and sympathetic a heart as the gentlest and mildest maiden. I have observed this in phy-

sicians and surgeons who were noted for having held the greatest number of autopsies. I account for it by the mastery over impressions and feelings held by a mind dominated by the idea of duty; viz., a strong well-formed and well-balanced character is able to overcome his repugnance to the hideous and shocking, precisely for the purpose of respect and goodness, braving the repugnance from a higher motive when there is need, sacrificing self when demanded by justice and decency. The same principle impels the good physician to insert the knife into the flesh and inspires him to endure the most exacting fatigue, endeavoring to prevent any suffering to the patient rather than avoiding an indecent or indelicate sight.

But the conclusion I draw is by no means negative or to throw doubt on the preceding considerations, or to limit inquiry. On the contrary, this is my conclusion: Since medicine alone is not able to make or mar the man, but its task is most critical, and the physician's aim most delicate and sublime (viz: not the recovery of an organ, but the health of the man), medicine ought finally to be understood not at all as a mercenary trade, but as a priestly office, a mission of devotion the function of which is charity; and we should require of the physician a proportionately moral superiority. Whenever found it is reasonable to attribute this superiority to individual character; and to doubt whether the discipline and curriculum of our universities makes any provision for it.

Psychology is not the same kind of a science as pure chemistry or pure mathematics whose object is something else than the subject which studies and observes. Psychology is the science of ourselves and our actions, and our actions are in process while being observed. It is the science of the self and nothing can be observed with regard to the self unless it be the self or a part of the self.

I do not think in the least that I am the first to make

a discovery in pointing out this singular condition of psychology which distinguishes it from all other sciences. My purpose is only to call the attention of the studios to a fact which should not be forgotten and to deduce from it a conclusion which may perhaps be new, and in any case stands out in bold relief. No science changes its object: the mathematician makes no change in the nature and relation of numbers; physicists and chemists do not create the phenomena which they report. If accidentally the environment disturbs the experiment and unexpected compositions are formed, the mistake must be at once corrected and the disturbing factor removed. Or perhaps a new property is discovered or it becomes clear that it is impossible to make the experiment; in any case the novelty of the phenomenon is not attributed to the experimenter simply because he observes it and makes a note of it.

In psychology quite the contrary is true. The observation that is made of the facts of the soul does not leave the facts as they were before. If I perceive that I am ignorant, I am no longer as ignorant as I was. If I perceive that I am wicked, I would naturally begin to overcome a part of my wickedness. He who perceives that he is in love is no longer in love in the same manner or the same degree as he was. Perhaps he becomes more so, perhaps less, but never the same. He who nurses his passion each day and each hour and examines it with a critical eye, either causes it to grow to the loftiest heights or else effaces it by his analysis. Never will it remain the same; never would he be able to say to himself, "Up to this point it was spontaneous; afterwards voluntary, cultivated." The spontaneous to which consciousness bears witness ceases to be spontaneous.

It is for some purpose that we are woven in the fabric of self, quite simple though it seems, and even with respect to matters which we deem of minor importance. If I per-

ceive that I am sick, perhaps in my stomach, I become at once a little more or a little less sick than before and the same thing is true if I perceive, if I state, if I declare that I am recovered, if I wish to recover. Nothing is more real than the diseases which are called imaginary. If this is true beyond doubt in the action of the first acts of consciousness, how much more true would it be in a series of acts of consciousness purposely continued, of attention, and of reflection, such as form the subject of psychology? Rosmini who pointed out this fact long before and much more clearly than Wundt, recognizes here one of the difficulties of introspective observations, and a less fortunate condition than that of physical observation.<sup>6</sup> But one might as well conclude that psychology, although absolutely lacking in scientific precision as it is, possesses after all a greater value than all science. Whether harmful or beneficial, psychological study would never be useless or indifferent. It is quite impossible that observation, study, and psychological science, or the concern for psychology, would not modify profoundly and to a great extent the soul, the mind, the affections, conduct, and finally society itself even if psychologists would not assume, even if they would refuse, the character of apostles. This then is another source of the considerations which lead us to conclude that psychology is not a curiosity such as laboratories make it or may make it. Nor is it only, as puny pedagogues teach, preliminary to the science of education; it is education itself.

In the self one should not admit the good and the bad, the higher and lower, the refined and the common, as two varieties equally interesting and worthy of study, but only the good, the higher and the fine should be admitted and cultivated. The evil, the lower, and the coarse ought not to exist, and if they do they should be exterminated. Psy-

<sup>6</sup> *Logica*, p. 952.

chology is not a curiosity; there is but one aim of science, perfection. The laboratory forgets this fact too often. I say it forgets, and do not refer to some criminal experiments which are not mere forgetting or due to ardor and which I would recommend not to science but to the regular police department. But even in simple negligence, even in that eagerness which has made of psychology a research into conditions and effects without consideration of endeavor and liberty, one may say that in spite of all its good intentions, the psychological laboratory destroys psychology and also ethics.

Should then the laboratory be suppressed and its doors closed? Not at all. I have said that I would state questions and not that I would draw conclusions. I would only make a proposition. It is not necessary to suppress anything or to close anything. It is necessary to uplift. Let us raise the standard of the laboratory. First of all it must become truthful. It can do so by dispensing with a name which is a contradiction. Psychology does not operate in a laboratory. The true laboratory of psychology is nothing but consciousness.

Here I shall insert a parenthesis, even if it destroys to some extent the harmony of my discussion, in order to answer in advance an important objection which may be made to my position. Apparently I have exposed myself to being addressed thus: In speaking of psychological laboratories you have limited your attention to the psychophysiological laboratories which measure the effects and the organic conditions of mental acts; you have ignored or neglected those other laboratories where measurements are not taken but records are made of observed facts, of statistics; as for instance how many of the one hundred individuals who daily enter the same door would be able to answer accurately questions about the number, size or arrangement of the windows of the building? Out of one

hundred pupils in a school how many will we find who are able to pay strict attention for a quarter of an hour, etc., etc.?

I have considered the point well. Measurement and the pretense of psycho-physical equivalence served the purpose of my argument more simply and clearly, but my aim was directed against every attempt to study the facts of consciousness outside of consciousness. There are three points of criticism which even the psychological laboratories that renounce physical measurements in favor of statistics, do not entirely escape:

1. Psycho-statistical researches can have no accuracy unless they take into account the organic conditions of race, health, development, and nutrition. That is to say, out of 100 there are perhaps thirty who pay attention and seventy of whom not one would have any opinion except with regard to how long it was since he had a meal, whether he slept well the night before, whether he is anaemic, who are his parents, where he comes from, how his stomach, heart and lungs perform their functions. Hence psycho-statistical researches have no value unless they are founded on psycho-physical investigation and measurements, and if they depend on these they are subject to the same criticism as the latter.

2. They also fall under the criticism of making a curiosity of psychology while forgetting that its purpose is education.

3. Statistical psychology having for its aim the establishment of a certain determinism also leads us to exaggerate its limits, but perhaps a little less than physiological psychology. Perhaps it can also give us some idea of those who exceed the ordinary limits and stimulate us by such examples to exceed them ourselves. But so much the better. I do not wish to be destructive.

However, the fundamental misapprehension remains,

—the illusion of studying outside of consciousness a fact which takes place only within consciousness and which outside of consciousness is not even conceivable.

Therefore let us retain and preserve experimental investigations on the nervous system, and if we wish to keep the name of psychological researches let us expand them. Instead of confining ourselves to studying limits, conditions leading to psychical disorders, or even to provoke them which would be criminal,—let us study in consciousness the power of the mind, endeavoring to see to what point in ourselves we can cultivate self-denial, the power of attention, growth, development of faculties, and of the hidden varieties of feeling, understanding and willing, the power of abstraction, devotion, affection. Let us care for the insane and the sick, but let us cultivate especially heroes, saints, and superior beings.

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## A BIOCHEMICAL CONCEPTION OF THE PHENOMENA OF MEMORY AND SENSATION.

FROM the earliest historical epochs to the present day, philosophers have expended a considerable proportion of their energies in framing replies to the question whether mental phenomena are, or are not, capable of resolution into law; of material, that is, physical or chemical, interpretation; of exact mathematical analysis. Not only philosophers, but also men of science, and others addicted to metaphysical speculation, have added their quota to a discussion the age and inconclusiveness of which has sufficiently demonstrated its sterility. As is customary in metaphysical discussion, the answers which have been propounded to this question are as numerous as the philosophers themselves. From the dualism which regards the mind as a species of "gaseous vertebrate" dwelling within but not, or only in a minor degree, subject to the physical and chemical laws which govern our material body, to the monism of Giordano Bruno which regards material objects as the "shadows of ideas," the mind the reality, matter the phantasm, and to the monism of Comte, which is the inverse of that of Giordano Bruno, every transition of opinion can be found, every shade of formulation, every compromise, and every absurdity which ingenious imagination, untrammelled by fact, can delude itself into believing.

One by one the problems with which the metaphysicians have busied themselves in the past have been wrested from

their hands, and received into that domain over which fact and not hypothesis rules; the domain of science. And it was inevitable that this ancient question must ultimately also acknowledge the suzerainty of science, for it was one which experiment, and experiment alone, could decide.

Those philosophers who postulated the superiority of mental phenomena over law, their freedom from the invariability of sequence and consequence which characterizes material phenomena, and, consequently, their immunity from exact formulation, measurement, and material interpretation, placed themselves in a position of considerable insecurity, for a single experimental proof of invariability of sequence and consequence in mental phenomena would set at nought their hypothesis and close the time-worn discussion for ever; the outworks once stormed, the citadel of their belief was doomed. This is why the exact and laborious investigations of Weber and Ebbinghaus, and of scores who have succeeded them, have definitely answered the question of the independence or interdependence of mind and matter and have placed science, once for all, in possession of the realm of mental phenomena—for these investigators have demonstrated that sensation and memory are capable of measurement and that they obey definite laws susceptible of mathematical formulation, and, therefore, of material interpretation.

But belief dies hard, and conviction of the futility of any discussion is a product of slow and painful growth, and thus it happens that among a large group of writers and thinkers (comparatively few of them biologists, however), controversy still rages over the question whether mental phenomena will ever yield to the all-conquering methods of science, and the belief still holds sway in that last outpost of primitive anthropomorphism, the "gaseous vertebrate," immanent within, but independent of the material organism.

It is possible that for a definite closure of this discussion, for the final annihilation of the naive anthropomorphism which holds humanity in thrall, we must look forward to ages coeval with the realization of the celebrated "world formula" of Laplace.

In order to be susceptible of scientific measurement, of comparison with standards, any quantity, whether it be a quantity of length, mass, heat or sensation, must be capable of being perceived directly or indirectly by the senses, and no mean portion of scientific advance consists in the opening up of new fields of research, and consequent knowledge, through the invention of new methods of bringing objects before the senses, and thus artificially enhancing their acuity.

It is not sufficient, however, that the object to be measured should be capable of being brought before the senses of a single individual—it must be capable of being brought before the senses of universal humanity; the phenomena observed, and the quantities measured, must be capable of indefinite duplication and repetition; for the evidence of a single individual, however careful his investigation, however exact his methods, and however sincere he may be, is valueless from a scientific standpoint unless the data constituting his evidence are obtainable by all. It is this possibility of indefinite reduplication which confers upon the data of science their certitude; for although "a plurality of suffrages is no guarantee of truth," yet a plurality of *evidences* is a guarantee of *probability*—and the whole edifice of natural science is nothing other than a vast outgrowth from the science of probability; in itself a group of inductions from universal experience.

Now it is true that the phenomena of our mental life are, to each one of us, individually perceptible, but they certainly are not, as a rule, perceptible, at present, to universal humanity. The mental processes occurring in A

are certainly very real and perceptible to him but he cannot, as a rule, measure them by any standards except his own, since those of B are inaccessible to him. Imagine a piece of iron which is conscious only of its internal condition and unable to compare it with external conditions, and suppose it were to try and measure its own length. It might do so by fixing upon an arbitrary portion of itself as the unit of length, and then perceiving that its total length was a certain multiple of this unit. Suppose, however, that at some subsequent period the temperature were to increase, and the piece of iron were to endeavor to repeat the measurement; its length would have increased, because iron expands with heat. But since each particle of the iron undergoes expansion in the same proportion, the piece of iron would imagine itself unaltered in length, since its length would still be the same multiple of its arbitrary unit; it would have no means of ascertaining that the length of its unit had increased, because it could not compare it with other, external units, which do not expand as the temperature rises.

A human being is, as regards the mental phenomena which occur within him, very much in the position of this hypothetical piece of iron. He is at the same time the observer and the observed, that which measures and that which is measured, and his conclusions from such internal measurements may possess an individual interest but are totally devoid of scientific value, unless the measurements are of such a type that they can be repeated by other observers external to himself; can be referred, in a word, to external standards.

But, the reader may inquire, how can the tenuous entities of thought, sensation, or memory be compared with external standards and be made evident to the senses of universal humanity? How can the chasm which divides our internal, mental life from the external, material world

ever be bridged? The answer is that this chasm is imaginary; an artefact arising from our peculiar situation of being at the same time the observer and that which is observed; a delusion which, it is evident, must be the inevitable result of the existence of consciousness in any body whatsoever.

Through what are we aware that human beings other than ourselves possess, like ourselves, consciousness, the ability to feel sensations, to store up memories, to experience emotions? Simply through a thousand material signs, which we note and interpret just as we note and interpret the multitude of material phenomena which assail our senses at every moment of our life. The only reason why our mental life appears to us so sharply divided from the external, material world is that we each possess, regarding our own mental life, "inside information." Through countless sources, by way of a thousand nervous channels, a thousand minute chemical changes in our blood or in our tissues, we possess at every moment a vast quantity of information regarding the happenings in our brain or spinal cord of which the external observer is, at present, necessarily ignorant. The task which, in this territory, faces science to-day is that of inventing means of throwing open these sources of information to the senses of universal humanity; of making available for comparison and measurements phenomena as yet inaccessible, buried in the consciousness of the individual. It is this task which, as regards sensation and memory, has been successfully initiated through the labors of Weber, Ebbinghaus and their successors, and there can be no doubt that, by methods however devious or refined, we shall ultimately complete the task so auspiciously begun, not only as regards the simpler phenomena of sensation and memory but also the most complex and recondite phenomena of our mental life.<sup>1</sup>

<sup>1</sup> It is obvious that the above considerations remain equally valid whether

A detailed account of the elaborate investigations which have sprung from the researches of Weber and of Ebbinghaus would, save to the specialist, be wearisome in the extreme; but the main results, and the principles underlying these, can readily be stated in concise form.

It is a matter of every-day experience that we cannot so readily perceive a slight difference between the strength of two stimuli, when the stimuli are large as when they are small. If we hold in our hand a pound weight we do not perceive a noticeable increase in the sensation of weight upon the addition to it of a tenth of an ounce; but if the weight which we are holding in our hand is an ounce then the addition to it of a tenth of an ounce will call forth a perceptible increase in the sensation of weight. In a brightly illuminated room the light of a candle makes barely any perceptible difference to the apparent illumination, while in a dark or poorly illuminated room a candle will appear to afford considerable illumination. During the decade 1840-50 Weber published an extensive series of investigations upon the amount by which a stimulus must be increased in strength in order to produce a just noticeable difference in sensation, and his results were formulated in the well-known Weber-law, which may be expressed in words as follows: "In order to produce a just noticeable difference in the intensity of a sensation the stimulus must always be increased in the same proportion"; that is, if we can just perceive the difference between the weight of an ounce and that of eleven-tenths of an ounce then we shall be just able to perceive the difference between the apparent weight of a pound and that of eleven-tenths of a pound.

we regard the universe from the point of view of materialism or from that of psychonism. Either point of view involves the conception of the essential identity of those phenomena which, at present, are accessible only to individual consciousness and those which are accessible to the consciousness of universal humanity. The distinction between materialism and psychonism is therefore a mere verbal quibble, comparable with that ancient and knotty problem, whether the owl first originated from the egg, or the egg from the owl.

If we can just perceive the difference between the intensity of illumination afforded by a sixteen candle-power lamp and that afforded by a seventeen candle-power lamp, then we shall be able to just perceive the difference between the illumination afforded by a thirty-two candle-power lamp and that afforded by a thirty-four candle-power lamp. If the addition to any given weight of one-sixteenth of its amount just enables us to perceive an increase in the sensation of weight which it calls forth, then we shall have to add to any other weight whatever, the same proportion, one-sixteenth of its amount, in order to similarly call forth a just perceptible increase in the sensation of weight.

Here was the first indication of a definite mathematical law obtaining in the realm of mental phenomena; the just noticeable difference in sensation was found to be a definite mathematical *function* of the strength of the stimulus calling forth the sensation; mental phenomena were delivered over, once for all, into the hands of the scientific investigator; the law of invariable sequence had again prevailed.

But in what manner, it may be asked, does this investigation differ from the endeavor of the hypothetical piece of iron, alluded to above, to measure its own length? Who is the judge of a "just noticeable difference in sensation" save the investigator himself? The answer is that the case is very materially different from that of the hypothetical piece of iron, in that the observation is capable of reference to external standards. It is true that the *subject's* consciousness of his own sensation is a thing which cannot be measured by any other standards than his own, but the *observer's* consciousness of the subject's sensation is capable of being measured by external standards, because it is derived from some material sign displayed by the subject. It is this material sign or *reaction* which is actually being measured. The subject is required to say a word or tap a key which closes an electric circuit, or per-



form some other definite preconcerted signal in order to notify the observer of the fact that he has perceived a just noticeable alteration in the apparent intensity of the stimulus; but he is not conveying to the observer his own consciousness of his sensation, derived from "internal evidence" unavailable to the observer. He is, on the contrary, conveying to the observer *his* consciousness of the subject's sensation, that is, a material token, differing in no sense from the countless material tokens wherefrom we infer that our fellow beings are, like ourselves, sentient organisms, and upon which, were it not for our "inside information" regarding our own cerebral states, we should have to depend for all our cognizance of mental phenomena. But material tokens can be reduplicated, recorded, and they, or the phenomena leading to them, can be measured by universal standards; whereas our internal consciousness of our sensations cannot.<sup>2</sup>

In 1885<sup>3</sup> Ebbinghaus published a series of investigations upon memory by means of which he demonstrated that this apparently intangible quantity could also be subjected to measurement. In order to exclude the distracting influence of the associations called up by the meaning attached to *words*, he used, as material for learning, syllables each composed of three letters and devoid of any linguistic significance whatever. A variable number of syllables were repeated until the first perfect repetition was secured. In the accompanying table are given his results, although

<sup>2</sup>The statement which is to be found in some psychological literature, that the perception of the "just noticeable difference" in the apparent intensity of a stimulus involves a *judgment* upon the part of the subject, is simply an example of that endless series of judgments, judgments upon judgments, judgments upon judgments upon judgments, etc., the simultaneous existence of which, within his own consciousness, any one can readily persuade himself by a few minutes of introspection. Thus "I know" being granted, there can be no question that "I know that I know," while the proposition "I know that I know that I know" is equally incontrovertible, and I could not have written this had I not known that I know that I know that I know; and thus this highly unprofitable concatenation of unrealities can be extended *ad absurdum*.

<sup>3</sup>H. Ebbinghaus, *Ueber das Gedächtniss*, Leipsic, 1885.



he did not succeed in expressing them in the form of a definite mathematical equation.

TABLE I.

Number of repetitions until the first perfect repetition.	Number of syllables in the series repeated.
I	7
16.6	12
30	16
44	24
55	26

The services thus rendered by Weber and by Ebbinghaus to psychology consisted, however, not only in reducing certain mental phenomena to quantitative, mathematical standards, but also in pointing out methods whereby measurements can be secured under constant experimental conditions. Given a constant condition of the subject during a period of the experiment (absence of fatigue etc.) and a constant rate of increase or decrease in the intensity of the stimulus (instantaneous), the only quantities varying throughout Weber's experiment are the intensity of the stimulus and a just perceptible alteration in its *apparent* intensity. Thus we are enabled to ascertain the manner in which the one varies with the other; we are enabled to ascertain, not only that the just noticeable difference in sensation is a function (in the mathematical sense) of the strength of the stimulus (i. e., that the just noticeable difference in sensation varies when the strength of the stimulus varies), but we are enabled to ascertain the precise character of the function, to formulate it in mathematical symbols thus:  $dR/R = k \cdot dS$  where ( $dR$ ) is the increase in the stimulus of strength ( $R$ ) which gives rise to a just noticeable difference ( $dS$ ) in the sensation and ( $k$ ) is, under the conditions of the experiment, a constant. Were the experiment of such a character that the

number of variable quantities could not be controlled in the manner outlined above, so that three or more quantities varied simultaneously during the experiment, then the problem of ascertaining the *function* connecting these variables would be much more difficult or even impossible. As we have seen, Ebbinghaus, by inventing ingenious methods of measuring memory, has not only shown that quantity of memory is a *function* of the time spent in learning, which is a matter of common knowledge, but has furnished us with data which, as we shall see, enable us to ascertain the exact nature of this function. Similarly, as Loeb has pointed out,<sup>4</sup> instincts are functions of the tropisms, but here extended research has still to be performed in order to learn how to eliminate adventitious variables and thus enable us to ascertain the exact nature of the functions.

This is the invariable procedure of science: first, methods are found of measuring or detecting the variables involved; next, methods are sought to isolate as few as possible of these variables and determine whether, and in what manner, they depend upon one another (in other words, what *functions* they are of one another) and then to admit more variables, as few as possible at the time, in order to determine in what manner these additional variables affect the relations subsisting between those originally chosen; thus proceeding from the simple to the complex, the particular to the general. This is the reverse of the procedure of the metaphysicians who, ignoring the particular in the search for the general, forget that the general is simply an anastomosis of particulars and that our knowledge of the general is therefore necessarily continuous with our knowledge of each of the particulars, of the functions connecting them and of the *manner* in which they anastomose.<sup>5</sup>

<sup>4</sup> Cf. J. Loeb, *Comparative Physiology of the Brain and Psychology*. New York, 1900, chap. XIII.

<sup>5</sup> "The aim of research is the discovery of the equations which subsist

The data obtained by the methods outlined above, alone constitute scientific *knowledge*. When we have determined, and can express in mathematical symbols, the *function* connecting two variables we have obtained all the knowledge that can be obtained regarding these two variables *per se*; but these methods alone do not lead us very far. The senses, unaided by the imagination, or by a knowledge of phenomena cognate to those under investigation, seldom, and then only by accident, perceive variables or relations subsisting between variables other than those of the most obvious description. It is here that the legitimate use of the *scientific hypothesis* is found. The scientific hypothesis is to be valued, not necessarily for its intrinsic truth, but for the fidelity with which it represents known phenomena, for the relations between variables which it indicates, for the hitherto hidden facts which it leads us to ascertain. An hypothesis is to the scientific discoverer what his telescope is to an explorer; it leads him to investigate new horizons, suggests to him possibilities beyond the reach of his unaided vision, stimulates him to fresh explorations. True, what he sees on the far horizon may only be the mirage, but he is stimulated thereby to research, and the result is that a fresh area is triangulated, a blank space upon the map is filled in.<sup>6</sup>

between the elements of phenomena"; Ernst Mach, "The Economical Nature of Physics," *Popular Scientific Lectures*, Chicago, Open Court Publishing Co., 1896, p. 205.

<sup>6</sup> It may here be pointed out, in order to remove some prevailing misconceptions regarding science, that scientific *controversy* invariably rages over *hypotheses* and not over *scientific knowledge*, i. e., ascertained facts or functions. The controversy is, however, frequently more stimulating than the rival hypotheses themselves, and may result in the unearthing of a vast body of facts which otherwise might not have been brought to light for a protracted period. Controversy over *scientific knowledge* is almost unknown to the history of science. True, observations are frequently made which are erroneous, but a subsequent observer invariably corrects the error of his predecessor. Every published experiment is repeated indefinitely, and, should difference of opinion regarding an observation exist, it is almost immediately set at rest by an overwhelming majority of affirmations upon one side or upon the other. Instances wherein *facts* have been the subject of prolonged controversy are so rare in the history of science that each instance is unique. A remarkable example of this rare class of discussion is that which took place over the so-

It is a remarkable fact that the results obtained by Weber and Ebbinghaus have, beyond a few immediate applications, done very little to extend our knowledge of the field of mental phenomena beyond that knowledge which was conveyed in the results of their own investigations. The field has been remarkably sterile, barren of suggestions and results. True, a vast number of minute and laborious investigations have been made upon the lines laid down by Weber and Ebbinghaus, but their result has been almost exclusively to confirm and amplify the results obtained by those observers. The reason for this is, I think, to be sought in the almost total absence of scientific hypotheses from the literature published by Weber, Ebbinghaus, and their successors. "The unfruitfulness of brain investigation is due, however, only partially to the difficulty of the matter. The main cause seems to be the entire absence of any working hypothesis, or even an approximate idea, as to the nature of cerebral activity."<sup>7</sup> Scientific investigation deprived of scientific hypothesis leads to an indefinite reduplication of similar results, an indefinite and sterile refinement of method and technique, and, finally, to the exhaustion of the field of research, until the discovery of entirely fresh methods, or the invention of hypotheses, opens up new fields of research, indicates unsuspected possibilities, relations hitherto undetected.

In what direction can we look for such a working-hypothesis in the field of psychology? As Loeb has pointed out<sup>8</sup> valuable clues are afforded by the tropisms. I believe that clues of equal value are afforded by the phenomena of memory; I will here only treat of the latter.

called "n-rays"; their existence was repeatedly affirmed and denied until the situation became intolerable and a host of investigators intervened to settle the dispute. The result of their labors was the obliteration of the n-rays and no one, so far as I am aware, positively affirms their existence to-day. Cf. an article by H. Pieron, "Grandeur et décadence des rayons N," *L'Année psychologique*, 1907, p. 143.

<sup>7</sup> F. A. Lange, *History of Materialism*, Vol. 3, p. 112.

<sup>8</sup> J. Loeb, *Comparative Physiology of the Brain and Psychology*.

The phenomenon which we colloquially designate memory but which, scientifically, might be more appropriately termed "associative hysteresis"<sup>9</sup> may be expressed thus: Certain mental phenomena occur more readily as a result of their previous occurrence. The mental phenomenon which we term the cognizance of a word renders more easy the repetition of that cognizance—we *remember* the word, that is, we can call up its image or sound so readily, after a certain number of repetitions, that we can finally dispense with the external image of the word altogether.

Various attempts have been made, of which the best known are those of Gall and Munk,<sup>10</sup> to explain the phenomena of memory upon a structural basis. According to these investigators each memory-image is localized in a particular ganglion-cell in the brain and is represented therein by a definite structure. This hypothesis has, however, proved completely sterile; no adequate evidence of this physical localization of memories has ever been adduced, even by its most enthusiastic exponents, while numerous phenomena are in flagrant contradiction with the hypothesis.<sup>11</sup> Moreover, even if such a structural modification occurs in the brain, it must be preceded by physical and chemical changes in the cerebral tissues, and it is therefore to physical and chemical phenomena that we must, whatever hypothesis is adopted, look for the origin of the memory-trace.

For various reasons, which I cannot dwell upon here, a purely physical explanation of the formation of the memory-trace must be excluded<sup>12</sup> and the search for a working-hypothesis regarding the formation of the mem-

<sup>9</sup> J. Loeb, *Arch. f. d. ges. Physiol.*, 115, 1906, p. 564.

<sup>10</sup> Munk, *Ueber die Funktionen der Gehirnrinde*, Berlin, 1881.

<sup>11</sup> Cf. J. Loeb, *Comparative Physiology of the Brain and Psychology*.

<sup>12</sup> Cf. T. Brailsford Robertson, *Archives Internationales de Physiologie*, 6, 1908, p. 433.

ory-trace narrows down to the question: What chemical phenomena are known which take place more readily in consequence of having already occurred? To answer this question we must make a short digression.

I have no doubt that the majority of my readers have heard of "catalysors," or, at any rate, of those catalysors which occur in the living organism and are termed "ferments"; but I suspect that very few have an accurate conception of what a catalysor *is*.

A catalysor is a substance which, when added to a mixture of chemical substances which are undergoing a chemical reaction, accelerates the reaction. It does not *initiate* the reaction, it cannot start a chemical reaction which would not otherwise occur, but it accelerates the reaction which is already taking place, by removing some resistance which hinders its progress. A catalysor is to a chemical reaction what axle-grease is to the rotation of a wheel; it removes the friction which prevents its rapid progress. The mechanism whereby the catalysor accelerates the reaction is, in most cases, perfectly well understood, and the phenomena of catalysis can be, and are, reduced to mathematical, i. e., functionalistic terms; the catalysors or ferments occurring in the living organism differ in no essential from ordinary, inorganic catalysors, and their action obeys the same laws.

A catalysor does not accelerate *every* chemical reaction; each catalysor accelerates a given reaction or group of reactions; thus zinc accelerates (i. e., *catalyses*) the transformation of alcohol into formaldehyde; finely divided gold, platinum, or charcoal, accelerate the decomposition of hydrogen peroxide into water and oxygen; acids accelerate the transformation of starch into sugar; the ferment pepsin, which occurs in the stomach, accelerates the chemical decomposition of the proteins of our food,—the list might be prolonged indefinitely.

There are certain reactions, however, which produce their own catalysors; that is, one of the products of the chemical transformation accelerates its progress.<sup>13</sup> It is easy to see what must happen in such a case; the reaction proceeds slowly at first but, as it continually produces more and more catalysor, it proceeds more and more rapidly until, as it approaches completion, that is, as the material undergoing transformation gets used up, the reaction gradually slows off. Thus the curve expressing the relation between the amount of material transformed, and the time, is S-shaped, expressing the fact that the reaction proceeds at first slowly, then more rapidly and then, again, more slowly. This curve furthermore expresses the fact that the amount of transformation is a definite function of the time, a function which can readily be expressed in mathematical terms. The essential feature of such a reaction is that it takes place more readily as a result of having already taken place to a certain extent.

Are there any indications of chemical transformations such as these occurring in living organisms? The answer is in the affirmative; the chemical phenomena underlying cell-division and growth are of this character<sup>14</sup> and it has been pointed out that the phenomena underlying muscular contraction are of this description.<sup>15</sup> As an example of such chemical transformations in the central nervous system I may cite the following.

<sup>13</sup> The "spontaneous" oxidation or "tarnishing" which many metals undergo when exposed to the air is a reaction of this type.

<sup>14</sup> As regards cell-division, cf. J. Loeb, *Biochemische Zeitschrift* 2, 1906, p. 34, and an address delivered at the seventh International Zoological Congress, Boston, Aug. 22, 1907. *Univ. of Calif. Publ. Physiol.* 3, 1907, p. 61. *Vorträge und Aufsätze über Entwicklungsmechanik*, Heft II, "Ueber den chemischen Charakter des Befruchtungsvorganges und seine Bedeutung für die Theorie der Lebenserscheinungen." Leipsic, 1907.

Wolfgang Ostwald and I independently and very nearly simultaneously pointed out that growth is also a phenomenon of this character. Cf. T. Brailsford Robertson, *Archiv für Entwicklungsmechanik der Organismen*, 25, 1908, p. 581; 26, 1908, p. 108. Wolfgang Ostwald, *Vorträge und Aufsätze über Entwicklungsmechanik*, Heft V, Leipsic, 1908.

<sup>15</sup> T. Brailsford Robertson, *Biochemische Zeitschrift*, Festband für H. J. Hamburger, 1908, p. 287.



It is well known that the rhythmic movements of respiration are primarily controlled by the medulla oblongata, or lower part of the brain. It is a classical fact of mammalian physiology that injury to a certain portion of the medulla results in instant cessation of respiration, and that circumstances affecting the condition of the medulla (i. e., heating, cooling, etc.) profoundly affect the character of the respiratory movements. Nearly every living tissue produces, as a result of its activities, carbonic and lactic acids, and there is no reason to suppose that cerebral tissue differs from other tissues in this particular. In fact I have shown, and others have shown, by different methods, that acid is developed in the brain as a result of stimulating sensory nerves.<sup>16</sup> Now it is a familiar fact that in suffocation the respiratory movements at first *increase* enormously in force and rapidity; the suffocating animal or man "gasps for breath." What is the essential feature of suffocation? The blood can, for some reason or other, no longer be ventilated in the lungs, carbonic acid gas cannot escape from the body and, consequently, the concentration of carbonic acid in the blood and in the tissues increases. As we have seen, the result of this is an increase in the velocity and force of the respiratory movements, and it is an obvious possibility that this increase in the rate of the respiratory movements is due to a direct action of the carbonic acid in the blood upon the tissues of the medulla oblongata. When one acid accelerates a chemical reaction others usually do so, and, in confirmation of the view expressed above, I have shown that when dilute acids are directly applied to the medulla of a frog, a marked increase in the rate of its respiratory movements takes place, often amounting to several hundred percent.<sup>17</sup> Here we have

<sup>16</sup> T. Brailsford Robertson, *Archives Internationales de Physiologie* 6, 1908, p. 388.

<sup>17</sup> T. Brailsford Robertson, *loc. cit.*



an obvious parallel to the self-catalysed chemical reactions described above. Acid is produced in the activity of cerebral tissue and acids accelerate its activity.

Here we have, also, the obvious suggestion of a working-hypothesis of memory. During the perusal, for example, of a printed word, acid is produced in some portion of the cerebral tissue, hence the word is more readily repeated until, after a certain number of repetitions, we can dispense with the external stimulus of the printed word and repeat the process of cognition spontaneously.\*

It is easy to show, but I will not here venture upon the necessary mathematics, that, for a limited number of syllables, it follows from the above hypothesis, namely, that the extent of the memory-trace is proportional to the amount of material transformed in a self-catalysed chemical reaction, that the number of syllables memorized must be connected with the number of repetitions (or time of learning) according to the following function:

$$\log n = Kr + b$$

where  $n$  is the number of syllables memorized,  $r$  is the number of repetitions, and  $K$  and  $b$  are constants (that is, do not vary when  $n$  and  $r$  vary).

We have seen that the measurements of Ebbinghaus have placed in our hands exact data concerning the dependence of the number of syllables learnt, upon the number of repetitions. For a given number of repetitions we can, from the above formula, calculate how many syllables should, were our hypothesis correct, be memorized—in the following table these theoretical deductions from our hypothesis and the data actually obtained by Ebbinghaus are compared:

\*) Since the above was written I have found that Wilh. Ostwald (*Vorlesungen über Natur-Philosophie*, Leipsic, 1902, p. 368) had previously put forward a suggestion embodying the germs of a theory of memory somewhat resembling that herein described.

TABLE II.

$r$ = number of repetitions.	$n$ = number of syllables memorized (observed)	$n$ = number of syllables memorized (calculated)
1	7	8.33
16.6	12	12.06
30	16	16.57
44	24	23.11
55	26	29.99

Data similar to those obtained by Ebbinghaus have been obtained by W. G. Smith<sup>18</sup> who, however, used methods of investigation differing somewhat from those employed by Ebbinghaus. In the accompanying table the figures deduced from the above formula and the data actually obtained by Smith are compared (Since these data are each the mean of a large number of determinations they are expressed as syllables and *fractions* of syllables):

TABLE III.

$r$ = number of repetitions.	$n$ = number of syllables memorized (observed)	$n$ = number of syllables memorized (calculated)
1	2.2	2.21
3	2.5	2.46
6	2.8	2.87
9	3.4	3.35
12	3.9	3.92

It will be seen that the calculated and the observed figures agree closely. Our hypothesis has already borne fruit. It has enabled us to anticipate the exact nature of the hitherto undetermined function connecting the amount of material memorized and the time of learning, and our anticipations have proved correct.

It can also be easily shown, but again I will refrain from the mathematics involved, that, provided our hypothesis were correct, the Weber law of sensation would ne-

<sup>18</sup> W. G. Smith, *Psychol. Rev.*, 3, 1896, p. 21.

cessarily follow; the Weber law therefore affords additional confirmation of the hypothesis.

One more illustration of the possible applications of the hypothesis and I will conclude. Every stimulus takes a certain time to be perceived; when we touch a red-hot coal we do not, as we imagine, instantly perceive the heat. Minute as the interval is between the application of the stimulus and its perception, it can nevertheless be accurately measured by the exact methods of experimental psychology. It can readily be shown that, were the above hypothesis correct, the period required to perceive a stimulus (for stimuli not too intense) should be connected with the intensity of the stimulus according to the following function:

$$t = A + \frac{B}{i} - \frac{C \log i}{i}$$

where  $t$  is the time required to perceive a stimulus of intensity  $i$  and  $A$ ,  $B$  and  $C$  are constants, that is, do not vary when  $t$  and  $i$  vary.

Cattell<sup>19</sup> has published a number of observations upon the time required for a color to be correctly perceived; his results for one subject and with orange light are compared, in the following table, with the deductions from the above formula, the time is given in thousandths of a second.

TABLE IV.

Intensity of the light	Time required to correctly perceive (observed)	Time required to correctly perceive (calculated)
I	.9	.9
$\frac{1}{4}$	1.1	1.0
$\frac{1}{16}$	1.25	1.25
$\frac{1}{64}$	1.75	1.8
$\frac{1}{256}$	2.5	2.4

The time required to read a page of a given size of print which is illuminated by varying intensities of light is

<sup>19</sup> J. McKeen Cattell, *Philosophische Studien*, 3, 1886, p. 94.

connected with the intensity of illumination according to the same formula, as the following table shows<sup>20</sup>:

TABLE V.

Intensity of illumination		Time required to read column of pearl type (observed)	Time required to read column of pearl type (calculated)
11.2	candle-meters	36 seconds	36 seconds
2.8	" "	36 "	36 "
.7	" "	46 "	46 "
.35	" "	63 "	64 "
.17	" "	110 "	110 "

The psychologists of old endeavored to unravel the tangled skein of mental phenomena through the unaided exertions of their intellect, and they succeeded only in rendering "confusion worse confounded." The modern psychologist has devoted himself almost wholly to measurement and description, and he has succeeded in measuring with the utmost refinement, it is true, a limited number of phenomena, but his field of investigation has been narrow, his horizon contracted. It appears to me that by a well-balanced combination of the two methods, by a judicious admixture of scientific hypothesis as a guide to scientific observation, we may hope to achieve, in the not too distant future, a scientific knowledge of mental phenomena not incomparable with our knowledge of phenomena of the external, material world.

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<sup>20</sup> Constructed from data published by Griffing and Franz, *Psychological Review*, 3, 1896, p. 513. The data quoted are those which were obtained with subject H. G.

## PSYCHOLOGY A DOMAIN OF ITS OWN.

WITH REFERENCE TO THE BIOCHEMICAL INTERPRETATION  
OF MENTAL PHENOMENA.

PSYCHICAL activity so obviously constitutes a class of its own that it has been regarded as radically different from any other natural phenomenon. Here lies the basis of all dualism, and here if anywhere must be sought its justification, which however is only relative. A close study of the situation leads to a monistic conception, but while monism removes the contradictions of dualism, it can not and should not slur over the contrasts of nature which actually exist.

Psychical phenomena are different from any other kind of natural happenings and it would be vain to deny it. Nevertheless there have always been advocates of a one-sided monism who claim that psychical activity can be and has to be explained from physical, or chemical, or perhaps biochemical facts; that therefore psychology should be regarded as a branch of physics and that from physics or chemistry we shall have to expect the solution of psychical problems. This view is quite common among a great number of naturalists and we deem it proper in the interest of our readers to have it presented in our columns by Mr. Robertson of the University of California, who in his line has done good work, but while the results of his labors may prove valuable in biochemistry we do not expect that they will contribute anything toward the solution of psychical problems.

It is perhaps natural that men of Mr. Robertson's type would look upon my views as inconsistent and think that theirs alone are truly scientific and monistic. On a superficial inspection my proposition appears dualistic, so I will here set forth my reason why I deem the naturalistic monism (as it might fitly be called) insufficient and untenable.

Not without satisfaction I note that among scientists, thoroughly familiar with chemistry and physics, Rignano makes a praiseworthy exception in that he most vigorously insists on psychology being *sui generis* and as different from physics as e. g. electricity is different from chemistry. We go further still and say that psychology being the science of the phenomena of the domain of subjectivity, has a character of its own different from all the sciences of objective phenomena, mechanics, physics, chemistry and physiology. This of course does not exclude that occasionally and in very important details these sciences will throw light on the mechanism or objective conditions of feeling and thinking, but they will never explain the properly psychical or subjective phenomena of the soul. Incidentally we will add that if Mr. Rignano had been familiar with the philosophy of form or the philosophy of science, as our view of monism may be fitly called, he would have been helped in working out his own theory and might have both deepened and broadened it.

We can not satisfactorily explain our objections to Professor Robertson's position without going over the whole field of psychological problems, but on account of their paramount importance we gladly take this opportunity to recapitulate our views in a concise form.

#### THE IMPORTANCE OF PSYCHOLOGY.

The laws of nature are the same for the whole realm of existence, yet we must recognize that there are differences of conditions, and we can classify different kinds of

phenomena according to their characteristic features into distinct groups. One of the most obvious divisions is the distinction between organized and unorganized nature, the latter consisting of the purely physical domains of existence and the former comprising all the phenomena of life, vegetal and animal, reaching its climax in the development of humanity.

If the whole of existence is one, we can not look upon the development of life, of animation, of consciousness and of rationality as some accidental by-play, but on the contrary we must regard soul, spirit, mind, or whatever you may call it, as the necessary outcome of the intrinsic nature of existence. Nevertheless organized life constitutes a domain of its own and within this domain the group of psychical phenomena is again a province with distinct characteristics which are absent in the domain of inorganic nature.

The attempts to explain psychology from physics or chemistry must therefore be futile, for the very elements of psychic life (the significance of subjective states) are not met with in those fields where the objective conditions alone (which are always matter in motion) are an object of investigation, viz., in molar mechanics, physics, chemistry and electricity.

A view of the world based alone upon physics and chemistry or in general upon the science of objective nature will always prove a failure, for it will never explain the soul. Thus we must invert the process and expect a solution of the world problem not from the lowest forms of existence but from its highest efflorescence. We must recognize the import of subjectivity which though apparently absent in pure physics, reveals itself in the consciousness of man, the noblest product of organized life.

If we want to understand the mechanism of objective nature in its complications, in its growth, in its wonderful

details, we must start with the simplest phenomena; but if we would like to know the meaning of the whole, the direction in which nature tends and the aim which by an intrinsic necessity it pursues, we must consider the highest phases of its evolution, for thus alone can we realize the potentialities that lie latent in the cosmic conditions.

Here lies the paramount significance of psychology, and we do not hesitate to say that the way in which the psychological problem is treated in a philosophy is always the best test of its worth.

#### THE DOCTRINE OF PARALLELISM.

The doctrine of parallelism has been generally accepted in psychology, but it must not be interpreted in a dualistic sense. There are not two separate factors, the psychological and the physiological, running parallel to each other, but there is one reality which has two aspects,—the one being the internal or subjective, the other, the external or objective. The two are as inseparable and yet different, as the internal and the external curves of a circle.

The character of the subjective domain exhibits the phenomena of sentiency, feeling, awareness, consciousness and self-consciousness in different degrees, beginning with the absolute zero of feeling and rising up to the concentrated attention of a rational being. The character of the objective domain is motion, gravity and momentum; chemical reaction, heat, electricity, vitalism, physiological functions and the action of premeditated purpose. The inner aspect of subjectivity always corresponds to the outer aspect of objective events. Both form a unit, and are mutually determined, or properly speaking, they are the same in two aspects. It is a parallelism of aspects, but not a parallelism of two independent realities.

I know that feeling is a reality, for I am feeling. I myself, as I am known to me, consist of feelings and so we



may say that feelings are the surest and most indubitable reality. Motion on the other hand is the object of my observation. I take note of changes that are taking place; they are modifications of my own being, the causes of which mostly do not originate in me, but are thrust on me and constitute otherness, or something thrown up against me—such is the literal and original meaning of the Latin word *objectum* derived from *obicere*. Hence their whole domain is called objectivity.

Our own body is part of the outer objectivity and only our feelings are subjective, yet these feelings animate the body and suggest at once that body and feelings belong to each other as outside and inside of the same thing.

The contrast between subjective and objective phenomena becomes most apparent in the fact that we can feel our own feelings, not those of others. We can see the motions that, judging from our own condition, we assume to accompany other creatures' feelings, but their feelings themselves can never become objects of observation or inspection. As feelings they are and remain forever subjective.

The two aspects are radically different, for feeling is not motion, nor is motion feeling. The soul is not body, and the body is not soul, but they are one, of which the soul is the inner, and the body, the outer aspect.

\* \* \*

Such is the doctrine of parallelism in its monistic interpretation, which, however, leaves the question of the nature and origin of consciousness open, and here I offer an explanation which, briefly stated, is this: Every objectivity has its subjective aspect, and is possessed of the potentiality of developing into actual feeling; but the subjective interior of purely physical phenomena cannot be ensouled with anything like actual feeling or awareness or conscious-

ness, because its inner commotions or subjective states remain isolated. Isolated feelings are not feelings in the proper sense of the word. In order to be actually felt, they must internally enter into a relation so that one feeling meets another feeling; two or several feelings must co-operate, so as to let one feeling feel the other. One feels while the other is being felt, thus producing the possibility of an interaction between several subjective states among themselves. Thereby alone can the feeling of a contrast originate, and only through the feeling of contrasts can a state of awareness result, yet any such internal interaction of feeling is possible only through organization.

This explanation tallies with facts established both by biology and by physiology, for we know that consciousness is always associated with a nervous system originating in these organisms which are moving about. Stationary organisms have to wait for the satisfaction of their needs, but a motor-endowed creature is enabled to go in search for food. In this way its organs learn to co-operate, and this imposes upon them unity of purpose. The unity of purpose produces the unity of the soul.

The characteristic distinction of living beings, when compared to physical phenomena devoid of life, is organization in so far as it renders possible a co-ordination of subjective states. Vitality is not a special force or substance; it is solely the function of organization, but as such it is a phenomenon *sui generis* and different from the forces of physics, chemistry, electricity or molar mechanics.

#### MEMORY THE PRESERVATION OF LIVING FORMS.

The typical feature of organization is the constant change of material which takes place in living substance. It is called metabolism, and in animal substance consists of a building up or anabolism, and a partial breakdown of the energy thus stored up, called catabolism. Anabolism

is nutrition; it changes food into living substance, a process called assimilation. Catabolism in setting energy free renders motion possible and this motion has under certain conditions its subjective aspect, which means that it is accompanied with feeling.

The partial breakdown of living structures called catabolism is not always the same but varies in form, depending upon the circumstances under which it takes place. It is a reaction upon a stimulus, and the reaction upon ether waves or light, air waves or sound, upon a touch of chemicals (as in taste or smell), or upon mechanical impacts are different physiologically as well as psychically. In other words: The irritation of light will produce one kind of structural change, while the irritations of sound and of touch cause other modifications, all of them being analogous; the same kind of cause corresponds to the same kind of physiological function, and each function possesses a form of its own and is accompanied by a feeling peculiar to itself.

Here the great significance of form for the explanation of life and of the soul becomes manifest. The *psyche* with its mentality, its reason, its purposes, its ideas, etc., would not be possible, if organization did not involve a preservation of form.

The waste material of a catabolic breakdown (mostly carbonic acid) is discarded, while through the anabolic process of nutrition the lost elements are again restored in the living substance, and this is done in such a way as to preserve the structure in its minutest detail. Thus the modifications produced by the reaction upon the several stimuli remain and constitute so-called vestiges or traces. In so far as this preservation of the form of living substance is accompanied by feeling, and as former feelings can be revived on the application of proper stimuli, it is called memory.

Memory, as Hering has pointed out, is a property common to all living substance; it is the indispensable condition of the development of the soul. The differentiation of nerve activity into the senses with its several modes of reacting upon the stimuli of the outer world, is due to a specialization of the several reactions in different spots, and this specialization becomes permanent through memory, which means through a preservation of the forms of the several reactions.

For a comprehension of psychology, viz., for our knowledge of subjective phenomena, it is quite indifferent what biochemical processes are its physical accompaniments; whether it is acid as Professor Robertson tells us which serves as a kind of axle-grease for the wheels of memory, or a salt or any other chemical. If we knew the whole chemistry of the brain it would throw no light on the slightest psychic action or mental process. Bio-chemistry can only solve the problems of the bio-chemical conditions of the brain and has nothing whatever to do with the mind as such. This statement does not involve a dualistic interpretation of mental phenomena but only demands the distinction between the spheres of subjectivity and objectivity which, though two aspects of one and the same reality, are after all radically different in their nature.

All events, states, and facts in this world are inter-related or correlated and all of them form one inseparable universe. But for that reason science distinguishes between different aspects, different features, and different qualities, and focuses its attention on one in order to comprehend those features which at the time are to be investigated. We have to obey this rule also in psychology, and thus the attempt to explain psychical phenomena from the physical facts would be about the same as to expect a demonstration of the Pythagorean theorem from experiments in chemical affinities. The attempt at solving

psychological problems from biochemistry would be about on the same level as if an art critic insisted that in order to explain the composition and meaning of Raphael's *Sistine Madonna* he would have to make a chemical analysis of the paints and the canvas Raphael used. The spirit of a book is not in the paper or printer's ink, and the soul of a man is not his body nor his cerebrum. The soul of a man is the meaning which his sentiments possess and the purposes which he pursues in life.

It is true that the investigation of the biochemical conditions of the brain will prove of great interest and will help us to better understand the nervous mechanism, but the nature of mental processes and their problem will remain the same as before.

Physicists are frequently in the habit of condemning even legitimate psychical investigation as metaphysical, and there are not a few who would regard psychology as only a branch of physiology. With reference to their claims we will say that they are frequently unfair to psychologists and misrepresent their views. For instance Professor Robertson speaks of the old metaphysical view as "the dualism which regards the mind as a species of gaseous vertebrate dwelling within, but not, or only in a minor degree, subject to the physical and chemical laws which govern our material body."

Even Thomas Aquinas would have demurred to this representation of his conception of the soul, and we would remind Mr. Robertson of the fact that the expression "gaseous vertebrate" has never been used seriously by any one who holds the dualistic soul-conception, and is merely a joke which Haeckel once made when referring to the anthropomorphic God-conception. An expression which is made as a jest can certainly not be used to describe the characteristic feature of a view to be combated.

Professor Robertson refers to the remarkable fact that

the results obtained by Weber and Ebbinghaus, with the exception of a few immediate applications, have done little to extend our knowledge of the field of mental phenomena and he believes, following Loeb, that "valuable clues are afforded by the tropisms" and further "that clues of equal value are afforded by the phenomena of memory."

As to the significance of memory we agree, but Professor Robertson instead of explaining memory (as we do) as a preservation of form, regards the processes of memory as physical and chemical phenomena, and compares the reaction of memory to catalysors which act in such a way as to make the reaction quicker by repetition, and this is done through the formation of acids. He says: "Here we have, also, the obvious suggestion of a working hypothesis of memory; during the perusal, for example, of a printed word, acid is produced in some portion of the cerebral tissue, hence the word is more readily repeated until, after a certain number of repetitions, we can dispense with the external stimulus of the printed word and repeat the process of cognition spontaneously."

Professor Robertson's reduction of this statement, to a mathematical formula,  $\log n = Kr + b$ , where  $n$  is the number of syllables memorized,  $r$  the number of repetitions, and  $K$  and  $b$  constants, may be very imposing to the general reader but adds nothing to the explanation of the phenomenon itself.

In spite of the merits of Professor Loeb especially in the line of physiological experiments, in which specialty he has distinguished himself, we can not see that psychology would be helped by calling some definite reactions which take place under some definite conditions "tropisms." We do not gain a scientific comprehension of these transactions until we gain an insight into the mechanism which upon a definite irritation causes organized life to move in a special direction and in a special way. New names do not explain,

however learned they may sound and we are little helped if memory is henceforth "scientifically and more appropriately" termed "associative hysteresis." The reason why psychological laboratories have added so little to our psychological knowledge is in my opinion the wrong notion upon which the experiments are based, that the soul can be measured quantitatively, and though measurements are quite helpful in many respects they will never throw light on the soul itself whose very character is of a qualitative nature. I know very well that the idea is quite common among certain naturalists that the notion of quality is not to be tolerated in science and that every problem is ultimately of a quantitative nature, but we demur and have set forth our reason in a special article, entitled "The Significance of Quality," which has been published in *The Monist*, Vol. XV, p. 375.

#### MEMORY THE SOUL BUILDER.

The most important service of memory is the part it plays in building up the soul. Memory creates the condition which begets the soul and then continues its further growth by adding and superadding new mental riches to its capacity.

First of all memory renders possible comparisons between the traces of past impressions and new sensations. Every memory image possesses a form of its own, and a sense-impression of the same kind travels on the path of its forerunner and revives its analogous memory trace which results in a feeling of sameness. The new sensation fits into the trace of the old one and is felt to be of the same kind. This feeling of sameness implies an act of recognition whereby the sense-impression gains meaning; and thus sense-impressions of the same kind come to represent the objects which cause them.

Here we have the principle from which we derive the

explanation of the soul, for the soul consists of feelings which have become representative of things, conditions, experiences, etc. In order to solve the problem of the origin of the soul we must show how sentiency acquires significance. Certain feelings come to stand for certain objects. They represent them. The living ideas of a man are sentiments freighted with meaning and the soul is a system of sentient symbols.

This solution looks very simple and it is simple indeed; but how grand and infinitely complicated are the corollaries implied. Consider that a symbol, or a representative meaning, is what it is by its relation to an objective reality, which may be a concrete object, a condition or a general feature of many objects, or a universal truth. There are false symbols and there are true symbols, and these symbols are not merely pictures of actualities, but also of aims, of aspirations, of ends to be attained. They have a pragmatic tendency. They possess moral or religious values, and these values may be true or false. They may lead in the right or in the wrong direction; they may be in agreement with the constitution of the All or they may be, as it were, out of tune. They may be more or less an incarnation of the world-order which sways not only stars and notes but also guides the thoughts and sentiments of man; and here we have a test of progress. Progress is not (as Spencer has it) "a passage from the homogeneous to a heterogeneous state," but the realization of truth. Progress means growth of soul, and growth of soul means growth of truth. The more clearly, correctly and completely truth is mirrored in a man, the higher he ranges in the scale of evolution.

EDITOR.



## CRITICISMS AND DISCUSSIONS.

### EASY NON-EUCLID.

In England Euclid is used as a synonym for elementary geometry. Let us use non-Euclid for elementary synthetic non-Euclidean geometry.

In ordinary Archimedean geometry, if we know the angle-sum in a single rectilineal triangle, we know whether the geometry be Euclidean or non-Euclidean; if the sect from the vertex of the right angle to the mid-point of the hypotenuse partition a right-angled isosceles triangle into two congruent right-angled isosceles triangles, which it does if that sect be half the hypotenuse, then space is Euclidean.

At last then we are able to understand, to marvel at the prophetic, the mystic clairvoyant genius of Dante, the voice of ten silent centuries, in connecting with the wisdom of Solomon and the special opportunity vouchsafed Solomon by God, a question whose answer would have established the case of Euclidean geometry seven centuries before its birth, or the case of non-Euclidean geometry three thousand years before its creation by Bolyai.

1 Kings iii. 5 is: In Gibeon the Lord appeared to Solomon in a dream by night: and God said, Ask what I shall give thee.

Then says Dante of his asking,

"'Twas not to know the number in which are

Or if in semicircle can be made

Triangle so that it have no right angle."

[O se del mezzo cerchio far si puote

Triangol sì, ch'un retto non avesse.]

Par. C. XIII, 101-102.

How unexpected, how startling this! Ever overlooked, yet now when found how strangely reinforced by Dante's ranking in

the fourth canto of the "Divina Commedia," with Cæsar, greatest of men, among exalted personages

"...who slow their eyes around  
Majestically moved, and in their port  
Bore eminent authority,"

Hippocrates of Chios who squared the lune, nearest that ever man came to the quadrature of the circle until finally Bolyai squared it in non-Euclid and Lindemann proved no man could square it in Euclid; and then Euclid himself, the geometer, the elementist, pre-emptor, by his unprovable postulate, of the commonly credited unverse, Euclidean space; and then Ptolemy, first of the long line of those who have tried by proof to answer the question Dante says Solomon might have asked God and did not, a question crucial as to whether Euclid's or Bolyai's space holds the actual world, the real thing.

Of course the treatise of the great astronomer, purporting to prove the parallel-postulate, miscarried, and hundreds after him spent in vain their brains in like attempts. What vast effort has been wasted in this chimerical hope, says Poincaré, is truly unimaginable.

Yet according to my genial friend Francis C. Russell, it is all so easy that he is only prevented from letting out the secret by fear lest he offend!

In the last number of *The Monist*, April, 1909, p. 294, he says: "The proof that the two secondary triangles are exactly equal to one another, that they are right-angled and isosceles. . . . is so simple in more than one way, that it would be almost an imputation upon the reader to spread it before him."

By what he does spread before us let us judge of the quality of his supposed proof. He prints from Lobachevsky: "24. The farther parallel lines are prolonged *on the side of their parallelism*, the more they approach one another." Yet he misses the point, that in this non-Euclid, parallelism is a *sensed* relation. As shown by Lobachevsky's very first figure, which he reproduces, page 291, through every point two intersecting straight lines are parallel to the same straight line in opposite senses. How then could any one pervert the theorem "15. Two straight lines which are parallel to a third in the same sense (toward the same side) are also parallel to one another" into applying to two straight lines parallel to a third in opposite senses? Yet this he solemnly does, saying, p. 302, "This looks to me very much like a proof that in all cases the angle of

parallelism is a right angle," and then impales himself on the following *reductio ad absurdum*: "Now by the very same course of deduction the line KAK' is shown to be parallel to HAH' and to EAE', in spite of the rather important feature that they cut one another at A."

With this before us, I think we can never hope from Mr. Russell a validly justified answer to Dante's question for Solomon, but his article is interesting if only for its very liberal quotations from the only English translation of Lobatchevsky, now rare, and for its amplification of a definition of the plane and the straight line given in 1904 as § 59, p. 29, of the first edition of Halsted's *Rational Geometry*.

The article is as follows: "59. If A, B, C be any three points not costraight, then (by the method used in 58) we can construct a point B" such that AB" is identical with AB and CB" is identical with CB:

"Therefore a point D such that no other point whatsoever, say D", gives AD" identical with AD and CD" identical with CD, must be costraight with AC."

The following have been given as definitions:

"If A and B are two distinct points, the straight AB is the aggregate of points P for none of which is there any point Q such that QA is identical with PA and QB identical with PB.

"If A, B, C are distinct points not costraight, the plane ABC is the aggregate of points P for none of which is there any point Q such that QA is identical with PA, QB identical with PB, and QC identical with PC."

Since in the book no use is made of the parallel postulate until after this article, we see Mr. Russell was mistaken in saying we have no applicable criterion showing that his straight, Euclid's and Lobatchevsky's are one and the same. But of course the alternative deduction he gives lacks this advantage, since in it he has unconsciously assumed the parallel postulate, assuming that every three points are costraight or concyclic. He also makes the unnecessary assumptions of the compasses (Halsted, *Geom.*, Appendix II, and Euclid I, 20, etc.).

Our *sects*, point-pairs alike or differing as to congruence, he calls intervals, our definition he speaks of as "a definition which so far as I know is a new one," and in trying to show "how the ruler may be derived by means of the compass (*sic*) alone," he does not

know that we have supplanted the compasses by a far simpler instrument, the sect-carrier, and that again by the unitsect-carrier.

GEORGE BRUCE HALSTED.

GREELEY, COL.

### CONSTRUCTION OF THE STRAIGHT LINE.

IN COMMENT ON MR. FRANCIS C. RUSSELL'S ARTICLE<sup>1</sup> "A MODERN ZENO."

Mathematicians will take an interest in Francis C. Russell's attack on the mathematical system of Lobatchevsky, whom he calls a "modern Zeno." If Mr. Russell is right we shall have to grant that there is a flaw in the arguments of Lobatchevsky on which he bases a new geometry that in contrast to Euclid's does not acknowledge the postulate of parallel lines.

Mr. Chas. S. Peirce in a letter to Mr. Russell thinks that he (Mr. Russell) overshot the mark. He says: "Those two lines cutting each other are *not* parallel and his (Lobatchevsky's) defining them as parallel to the third was in obvious contradiction to the proposition that two straight lines both parallel to a third are necessarily parallel to each other. I press the question, Why did you not content yourself with this obvious proof of the incorrectness of his proposition No. 25? The answer seems to me obvious. If you had done that your readers would have at once perceived that Lobatchevsky merely made a slip of the pen and *meant* that two straight lines parallel to a third *toward the same side* are parallel to each other."

Though Mr. Russell may have gone too far, he has called attention to a mistake which ought to be corrected, and Mr. Charles S. Peirce, in thoughtful consideration of the difficulty which puzzled Mr. Russell, points out the flaw.

But metageometricians are not so considerate. They claim that he has thoroughly misunderstood non-Euclidean geometry. We publish in the present number two criticisms, one by Professor G. B. Halsted, the other by W. H. Bussey, assistant professor of mathematics at the University of Minnesota.

Metageometricians are a hotheaded race and display sometimes all the characteristics of sectarian fanatics. To them it is quite clear that there may be two straight lines through one and the same point which do not coincide and yet are both parallel to a third

<sup>1</sup> See the April number of *The Monist*.

straight line. I do not mean to take issue here for either Euclidean or non-Euclidean but I wish to say that the subject is difficult, that mathematicians are by no means so positively agreed on the subject as some metageometricians claim. If Mr. Russell is wrong, the admirers of Lobachevsky are welcome to point out the mistakes in his objections. Mr. Russell has made no positive assertions, he has expressed his incredulity as to the soundness of Lobachevsky's arguments and asks for further information on the subject. The problems of non-Euclidean geometry are not quite so simple, nor the solutions of Lobachevsky so self-evident that a modest question on the subject would not be in order; but the editor is seriously requested to submit manuscripts to a mathematician (presumably an orthodox non-Euclidean) and to suppress all heretical articles. In reply to this request I will state that I frequently publish articles setting forth views which I do not endorse, because I believe that they are worth being noticed, considered and perhaps refuted. Mr. Russell, for instance, raises another issue (viz., the problem of a construction of the straight line) on which the greatest mathematicians have made the most divergent statements.

Leaving the discussion of Lobachevsky's geometry to the non-Euclidean I wish now to criticise Mr. Russell for his construction of the straight line.

Mr. Russell attempts to define and develop the straight line by purely *a priori* methods and does it without the ruler, limiting his method to the use of the compasses. He constructs three spheres, and by the use of the compasses only he lays down a range of points which in their totality mark a straight line. Incidentally he refers appreciatively to my book on the *Foundations of Mathematics*, and I gladly note many points of agreement which, however, Mr. Russell has worked out in perfect independence. Like myself Mr. Russell calls attention to the significance of even-boundary conceptions the value of which consists in their uniqueness, and he is pleased with the term "anyness"; but I would suggest that if he had adopted my view of the foundation of mathematics, he would have deemed it redundant to construct the straight line as he does, and would be satisfied to produce it (as I have done) as an even-boundary conception; for after all he shares the mistake of all attempts of the same kind, in that while constructing the straight line, he presupposes it. He says most impressively when speaking of the indispensableness of the straight line (and I subscribe to every word of it): "All things in mathematics have been made by it and without

it has not been made anything that has been made." But even while making the statement Mr. Russell forgets this truth for a moment and inadvertently proves it in his very construction of the straight line, for he presupposes and uses conditions which involve the straight line, while he attempts to lay it down with the help of the compasses.

The same idea, at least in its principle, has been suggested before by Fourier who proposed a new construction of the straight line in the following way. We quote from an article by G. B. Halsted in *The Monist*, IV, p. 485:

"Take any two points on any solid. Let one remain at rest while the solid moves. The other describes a sphere. Two spheres intersect in a circle. If the spheres are equal and grow, this circle describes a plane. If the spheres touch and one decreases as the other grows, their point of contact describes a straight."

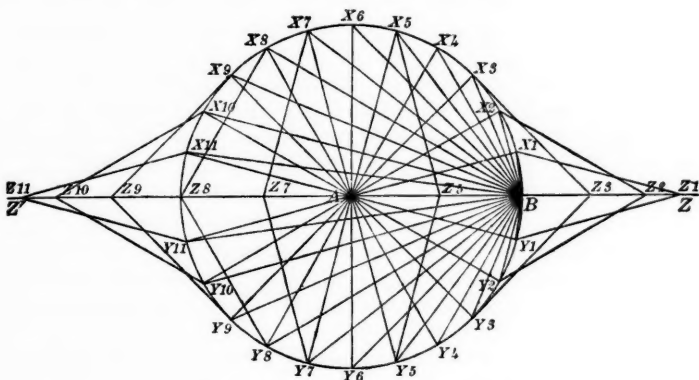
Fourier's construction of the straight line suffers from the same faults as that of Mr. Russell. Both presuppose the straight line, both are constructed in a homaloidal space, under conditions of anyness, which renders the distance between two points definite. This definite distance between two points is determinable (i. e., measurable) only by a straight line. If we could not measure distance so as to be sure that it does not change while the moving point travels around the stationary point, there would be no use of the construction.

Almost every metageometrician remains unaware that everything he does he accomplishes through the instrumentality of the straight line, and that the straight line is indispensable even if we draw a circle. Here we have good evidence of Mr. Russell's dictum concerning the straight line, that "all things in mathematics have been made by it and without it has not been made anything that has been made."

Mr. Russell, as well as M. Fourier, starts with the construction of a sphere and naturally makes use of the radius. But what is the radius but a straight line, the straight line being the measure of the distance between two points? When we lay down two points at a definite distance we imply the straight line which is our only means of uniquely, i. e., unequivocally, determining distance, otherwise we have no means to distinguish radii of different lengths. It is evident that these two constructions, Mr. Russell's and M. Fourier's as well as all others which produce the straight line by some such legerdemain, presuppose the notion of an even space, or of distance that remains

the same, or of a scope of motion under conditions of anyness. All three being different expressions for practically the same thing.

The issue which I raise is no quibbling and will be driven home to the reader who would try to construct the straight line with a pair of compasses that are not firmly set. He will have again and again to assure himself that the distance has remained the same. When we construct circles we presuppose an even (or homaloidal) scope of motion. We presuppose that distances are definite and measurable. We presuppose the existence and workableness of the compasses. The ruler is first and the compasses second. The circle, being begotten of the radius, presupposes the straight line. In fact the compasses determine the size of a straight line, for the essential part of the compasses consists in the adjustability of its two points,



not in the two legs. The two legs are merely a convenience. They are the machinery to fix the points and a handle to turn them in their fixed position. We might as well use a string pinned down at one end and having a pencil at the other; and what is a string stretched tight if not a materialization of the straight line?

We here reproduce Mr. Russell's diagram which shows on two circles what he proposes to do with three spheres for the sake of developing the straight line by means of the compasses only and without the ruler. In order to show the several openings of the compasses used, he draws the radii and thus makes visible what they involve. Just look at all these straight lines which are here introduced as auxiliary constructions, and there are still more of them doing obstetrical service for the birth of the straight line from the

cooperation of the three spheres. The very spheres themselves have been begotten by the straight line, which first performing the function of a radius, made one end stay in one place (the center) and let the other swing around it; then having created the circle it was again the straight line which as a diameter of the circle served as an axis of its rotation so as to produce the sphere. Verily Mr. Russell is right and we repeat his proposition with religious solemnity. All things in mathematics have been made by the straight line.

Mr. Russell's contention would be proved only if he could make his construction with the circle alone and dispense with the ruler entirely; he should also dispense with it in his proof. But he can not. His construction does not create a straight line; in fact it creates no line at all, but only (as he says himself) a range of points, and all we have to grant is that his range of points lies in a straight line. But how does he prove it? How do we know and in what way can the site of this range of points as being in a straight line, be determined? We can determine it only by having a clear conception of a straight line and bringing it to bear on our range of points. We must make the straight line run through the range of points thus constructed by Mr. Russell and prove that they all lie in the path of the straight line. In other words, any range of points does not constitute a line, and unless we have the idea of a straight line, we can not bridge the distance between any two points (let alone a great number of points) and then declare that we have accomplished the task.

The fundamental error of Mr. Russell, M. Fourier, and all who have made kindred attempts, consists in the assumption that mathematics has to start from a blank and is an *a priori* construction out of nothing. Mathematics starts from an absence of all concrete existence, and this can be called "nothing" only in a certain sense. The domain of mathematics is a nothingness in the sense of an absence of all materiality, of all forces, of energy, of all bodily existences, and of all concreteness. As I have expressed it in my *Foundations of Mathematics*, the mathematician starts from a state of "anyness" and this absence of all concrete existence is not an absolute nothing. Anyness involves homogeneity and homogeneity is the characteristic feature of mathematical space—the scope of motion for the mathematician's operations.

The mathematician performs operations, but his operations are pure motions of anyness, which means they are stripped of all par-



ticularity and concreteness. They are devoided of matter and energy with all their qualities. Thus the determination of a locus is a mere point without extension and its motion produces mere length without breadth or thickness, etc. Everywhere we meet with that subtle fabric of anyness which is a true nothing in the sense of the absence of everything concrete, but not an absolute nothing. In this anyness the mathematician operates and his mode of operation is a work of anyness.

Mathematical space which is the domain of anyness in which the mathematician performs his operations, includes the possibility of constructing even boundaries, and even boundaries are needed for mathematical constructions on account of their quality of being unique. Uniqueness is needed in order to have a standard of reference. The three even boundaries which thus recommend themselves by their uniqueness as standards of reference, are the straight line, the plane, and the right angle, and they make it possible to construct parallel lines. Accordingly it is obvious that the problems of the straight line, of the plane, of the right angle, of the sum of the angles in a triangle as equal to two right angles, and of parallelism are practically the same problem, and it is impossible to construct any one of them from nothing with the help of pure logic only. In addition to pure logic, the mathematician needs for the construction of his science the concept of anyness which yields that most indispensable quality of mathematical space, homogeneity without which mathematics would be impossible.

This idea of anyness is a product of abstraction and the mathematician should know its origin as well as its application in order to understand the foundation of his science.

EDITOR.

#### SOME REMARKS ON MR. RUSSELL'S ARTICLE, "A MODERN ZENO."

I have been reading with interest the April number of *The Monist*, especially "The Choice of Facts," by H. Poincaré, and "A Newly Discovered Treatise of Archimedes," by J. L. Heiberg. I was attracted by the title "A Modern Zeno," and I was very much surprised to learn the identity of the man. Mr. Russell, the writer of the article, has evidently made some study of Non-Euclidean Geometry, especially of the writings of Lobatchevsky. But truly "a little learning is a dangerous thing." His study has been super-

ficial and without understanding. It is not my intention to criticise the article in detail, but to point out two errors that make it almost worthless.

On page 294, it is stated that the straight line containing the vertex of an isosceles right triangle and the midpoint of the hypotenuse divides the triangle into two equal isosceles right triangles. That these two triangles are equal right triangles is true in the geometry of Lobatchevsky, but that they are *isosceles* cannot be proved from his assumptions, although Mr. Russell says that the proof is so simple that it would be an imputation upon the reader to spread it before him.

On pages 300-302, Mr. Russell has given what he thinks is a proof that the geometry of Lobatchevsky is self-contradictory. His error is due to the fact that he used Theorem 25 without understanding it. It is true that he has stated it in the exact words of Halsted's translation of Lobatchevsky's *Researches on the Theory of Parallels*, namely "Two straight lines which are parallel to a third are parallel to each other"; but either he did not read the proof given there or he did not understand it. The theorem as stated is incorrect or perhaps I should say it is incomplete. But this fact would not have been misleading if he had read and understood the proof. On page 34 of H. P. Manning's *Non-Euclidean Geometry*, the theorem is more carefully stated as follows: "Two lines parallel to a third toward the same part of the third are parallel to each other." Indeed it is stated on page 13 of Halsted's translation that in the geometry of Lobatchevsky we must make a distinction of *sides in parallelism*. Mr. Russell's failure to take account of this distinction vitiates his argument. That he has utterly failed to comprehend the distinction is evidenced by the following statement taken from the bottom of page 302: "Now by the very same course of deduction (no step of which is unsanctioned in the 'system' of Lobatchevsky) the line KAK' is shown parallel to HAH' and to EAE', in spite of the rather important fact that they cut one another at A."

It seems that Mr. Russell has some doubt as to the correctness of his conclusion, for on page 303 are these words: "Still it may be that there is something about the matter that I do not understand. If so, I can only protest that my failure is not due to any lack of respectful (I do not want to say absurdly respectful) study of Lobachevsky's little brochure." It looks to me as if Mr. Russell did want to say "absurdly respectful." My comment is this: Perhaps

it was respectful. Certainly it was superficial and without much comprehension, especially in connection with Theorem 25. The first of the two errors I have mentioned shows his lack of understanding of the details of Lobatchevsky's geometry, but it is not so serious because it led him merely to some remarks about a "bent plane." The second error is more serious because it led him to the conclusion that Lobatchevsky's geometry is self-contradictory and that "we find Lobatchevsky hitting upon the right and sufficient way of proving the parallel postulate of Euclid."

*The Monist* is devoted to the philosophy of science, and articles on Non-Euclidean Geometry are certainly not out of place in its pages. A good paper on the subject or its philosophic import may be written by one who is not an expert mathematician, but it seems to me that such a paper should be carefully read by an expert mathematician before publication, so that errors due to the author's lack of knowledge of the technique of the mathematics involved may be eliminated. Certainly this should be done when an author thinks he has found a fallacy in a doctrine accepted as sound by mathematicians the world over.

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#### PROFESSOR LOVEJOY ON "DER VORCHRISTLICHE JESUS."

The following reply to Professor Lovejoy's criticism was promised in a footnote for the January number of *The Monist* and was in fact written out in full nearly two weeks before October 29, 1908, when I sailed for Chile. But as the protracted absence from the United States that followed rendered it quite impossible either to give the paper final revision or for me to see the proofs, if it should be issued in January, it seemed best to hold it back for the present number. The occasion for any rejoinder whatever is supplied not by the argumentative appeal of the review, which may be safely left to the judgment of readers of the book, but by its strictures upon the author's treatment of authorities, especially of Hippolytus.

*Imprimis*, let me thank Professor Lovejoy for the general manner of his review. While not exposing fully the argumentative nerve of the work in hand, he seems really to have intended to get at the heart of the matter, and his statement of the main drift of the essays calls for acknowledgement. Moreover, he has not shrunk

from making certain concessions, which seem to be far-reaching, however restricted they may have been in the purpose of the reviewer.

I. It is particularly in dealing with Hippolytus that Professor Lovejoy's criticism calls for comment. He has, in fact, in terms doubtless meant to be as delicate as possible, charged upon me unfairness in citation. He quotes from p. 123 that Hippolytus "declares repeatedly that the Naassenes were the first of the heretical sects, from whom all the others afterwards known as Gnostics derived (*Ref.* V. 6, 10, 11)." "We may quite definitely conclude, therefore, in agreement with Hippolytus, that Naassenism was antecedent to Christianity, that it flourished before the Cross was preached, and that the later forms of Gnosticism were its offspring" (p. 124).

To these sentences, thinks Professor Lovejoy, the readers of Hippolytus will "revert with some astonishment." First, he denies that H. in the "passages cited makes any such statement as that ascribed to him, about the descent of all other Gnostic doctrines from Naassenism"; secondly, he declares that "H. in plain terms describes the Naassenes as Christians. They are classified as a 'heresy'; they taught that the archetypal Man 'descended in one man, Jesus, who was born of Mary' (V, 6); they traced their doctrine 'through Mariamne to James, the brother of the Lord'—which, of course, shows them not only Christian but also, at earliest, of the first or second generation *after* the Apostles. Dr. Smith's omission to mention any of these statements of H., and his citing of that authority as a witness in favor of a view of the date of the Naassenes which the very same chapters of the *Refutatio* categorically contradict—this is a thing so amazing that it is difficult to comment upon it with propriety." In a word, the gravamen of his charge is that the author has suppressed statements of H. that show precisely the opposite of what the author ascribes to H.

Let us see. It may not be necessary to weary the reader with citation, but in any case the matter is too serious to pass over lightly.

Does H. declare repeatedly that the Naasseni were the first Gnostics? Book V of the *Refutatio* opens thus: "The following are the contents of the fifth book of the Refutation of all Heresies: What the assertions are of the Naasseni who style themselves Gnostics." It is not here said of the following Peratae, Sethians, Justinians, that they called themselves Gnostics, but only of the Naas-

seni. To my mind there is here a general identification of Naassenes and Gnostics, stated almost as clearly as Hippolytus states anything. Again H. proposes here (and the sentiment is repeated in VI, 6 and X, 9), "to begin from those that have dared to celebrate a serpent, the author of the error (τὸν αἰτίον τῆς πλάνης γεγόμενον ὄφιν ὑμνεῖν) . . . . The priests then and champions of the system (δόγματος) have been *first* those surnamed Naasseni (πρῶτοι οἱ ἐπικληθέντες Ναασσηνοί), in the Hebrew tongue so named—for the serpent (ὁ ὄφεις) is called *Naas*." The decisive adjective *first* is seemingly unobserved by Professor Lovejoy,\* who remarks queerly that the phrase "afterwards called themselves Gnostics" "does not imply that they were the only or the first heretics who did so." Apparently in eagerness to convict the author of misstatement, Professor Lovejoy seems to overlook logical pitfalls. If the Naassenes were not the first Gnostics, then the latter must be even older than the author maintains, which would strengthen the general position of his book perceptibly. These Naassenes who called themselves Gnostics were the *first* in championship of the dogma (Gnosticism). If this does not mean that they were the first Gnostics, what does it mean? And if they were not the first, who pray were the *first*? And who were the others, if they were not the only? H. continues: "Afterwards they surnamed themselves Gnostics, declaring they alone knew the depths." There is no hint that they took the name Gnostics from any others; they surnamed themselves so for a specific reason: they nicknamed themselves *Knowers*, because they *alone* did know. The only fair understanding of such words is that the surname Gnostics originated with these Naassenes; in the absence of any counter-indication, we must affirm as much. H. proceeds: "From whom many having parted off multifariously constituted the heresy, though essentially one, in different dogmas detailing the same things, as the discussion as it advances shall prove." From this passage, in connection with others similar, I have inferred that H. would represent the Naassenes, surnamed Gnostics, as the first Gnostics, from whom all other Gnostics sprung, the heresy having parted into many subdivisions. Is not the inference fair? Professor Lovejoy holds that it refers "merely to the diverse subdivisions of the Ophite Sect." But Ophite Sect means Ophites, and this is merely the Greek for Naassenes (ὄφεις = *naas*, says H.), and this was the earlier name for such as "surnamed

\*But not by Mansel, e. g., who repeatedly speaks of these sectaries as "first," "earliest Gnostics." "The Naassenes, the earliest sect according to the arrangement of H., are spoken of by him as the first body who assumed the name of Gnostics" (*Gnostic Heresies*, 7, 95, 104).

themselves Gnostics." That my interpretation was not forced, but perfectly natural, is made clear by the remark of Dr. Salmond in a footnote to his translation of H.: "*γνώσις*,—a term often alluded to by St. John, and which gives its name "Gnosticism" to the various forms of the Ophitic heresy." The position of the great English scholar, who certainly has no bias in favor of *Der vorchristliche Jesus*, seems to agree precisely with the position which Professor Lovejoy so criticises—and yet seems to adopt as his own!

Further on (V, 8) H. designates these same Naassenes outright as "the Gnostics": "Following these and the like, the most marvelous Gnostics, inventors of a new grammatic art...."

Again, in quoting the Naassene Parable of the Sower: "That is, he says, none becomes a hearer of these mysteries except only the *gnostici perfecti* (οἱ γνωστικοὶ τέλειοι)."

Again, (V, 11): "These (the foregoing) doctrines, then, the Naasseni attempt to establish, naming themselves Gnostics. But since the error is many-headed and diversified, as in truth the hydra that history tells of, when at one blow, wielding the wand of truth, we have struck off the heads of this (heresy) by means of refutation, we shall exterminate the whole monster. For neither do the remaining heresies show off much different from this, being mutually connected in spirit of error. But since, altering the words and the names of the Serpent (*ὄφεις*), they wished there to be many heads of the Serpent, neither so shall we fail to refute them as they will." So closes H. his 38-page long treatment of the Naasseni. The extreme length of this treatment, greater than is given any other single heresy, shows clearly their decisive importance in his eyes. Playing on the terms Naas and Ophis, he likens this Naassenism (Ophism) to a Hydra, he seems to identify it with Gnosticism, he thinks that in beheading it he has beheaded all heresies, since the rest (*αἱ λοιπαὶ*) are held together (with it) in spirit of error; he does not regard the rest as really worth while; nevertheless (*ἀλλ'*), since they are heads of the same Serpent (that is, outgrowths of the same Naassenism—Ophism), he will smite them also one by one, and *this he straightway proceeds to do* in the remainder of his work. If not then quite as plain as day, it is at least as plain as anything in the *Refutatio*, that H. regards his task as in principle fulfilled with the slaughter of the Hydra or Serpent of Naassenism; but to make assurance double sure he will thrice slay the slain, he will smite to death through his following pages every form of the many-headed monster. The simile is faulty, but the meaning is clear.

Manifestly H. must and does regard these "remaining heresies" as second in importance and still more in time. The multifission of the Hydra must follow and could not precede the Hydra itself. It is evident beyond argument that H. regards these "other heresies" as later and as offshoots of primitive Naassenism. He does not indeed say "all other heresies," but he does say "the remaining heresies." The meaning is the same. H. is speaking of a class of things, and a single class, and the "all" was not necessary. He was not careful to guard against quibbling that he could not anticipate. This use of the article in a universal sense is regular in Greek. Euclid does not say "All parallelograms on equal bases and between the same parallels are equal to one another" but "*the* parallelograms" (*τὰ παραλληλόγραμμα*); so in the famous 47th it is not "in *all*" but "In the right-angled triangles" (*ἐν τοῖς ὀρθ. τριγ.*) The case is not different in English; says the master logician, W. Stanley Jevons (*Elementary Lessons in Logic*, p. 65) "I shall frequently use propositions in the indefinite form as examples, on the understanding that where no sign of quantity appears, the universal quantity is to be assumed. It is probable that wherever a term is used alone, it ought to be interpreted as meaning the whole of its class." Such is plainly the necessary interpretation here; for if not all forms of Gnosticism be derived from this primitive (in H's estimation), then he must have supposed some other independent primitive. But is there the slightest shred of evidence that he ever assumed two original sources of Gnosticism? Or that there ever was any other than the one Ophitic source? *Entia non multiplicanda sunt praeter necessitatem*. This razor of Occam shears off any other stem until its necessity is proved, and no proof has ever been attempted. What form of Gnosticism was there that could not be traced back to Naassenism, in H's conception? What Dr. Salmond thought of the matter appears clearly in the heading he has given to this chapter VI: "The Ophites the Grand Source of Heresy," and again to chapter I, Book VI: "The Ophites the Progenitors of Subsequent Heresies."

I should here remark that in my original thought only the first part of Professor Lovejoy's quotation, was intended as a declaration of H., "That the Naassenes were the first of the heretical sects"; the following clause, "from whom etc. derived," was intended merely as my own inference gathering up the diffuse and disconnected deliverances of H. into a single statement. The reader now has the facts sufficiently presented, and in view of them I maintain with added emphasis that the natural and hardly avoidable inference from



the words of H. is that he regarded all "the other heresies" or forms of Gnosticism as diversifications of primitive Naassenism. Possibly the language of the text may sound a little dogmatic, but the explanation is easy to find, by glancing at the opposite page, 122, where it is stated that unfortunately it was not possible to go into details at that point, but that only the general lines of the argument could be laid down. In fact, the detailed treatment of the *whole* testimony of H. has for some years lain in my desk in manuscript, waiting upon a similar treatment of Irenæus, not yet completed, the two to be published together. Pages 122-4 merely resumed under heads A, B, C, D in briefest terms some main results of that study. But even as it stands there is naught to retract. The statement of the text is borne out by comparison of all the pertinent passages in H.

Of itself the criticism of Professor Lovejoy may not seem to call for so much attention; but it may be properly used as an occasion to set an important matter in clearer relief.

However, it is not this quotation that most moves the amazement of Professor Lovejoy, not to say his virtuous indignation. It is the alleged suppression of the alleged counter-testimony of H., that the Naassenes were at the earliest post-apostolic. Now if the pages in question had professed to give full discussion of the matter, this "omission" might justly have excited more than marvel. In fact, however, they profess no such thing; they give intentionally *no discussion at all* but merely state certain results to which the writer had been led by a minute study, yet unpublished. Now these results were *all* that the pages professed to state; the minute investigation is a large part of a volume yet in manuscript. In that volume the reader will find a discussion of the passages referred to by Professor Lovejoy—a discussion almost painfully minute. The *results* stated on page 123 are not in the least affected by the passages in question. They hold firmly in spite of those passages. Such being the case, I felt and still feel myself justified in stating the results arrived at, without any mention of passages that do not really invalidate those results. In such a summary statement of conclusions it would be out of place to refer to objections that do not really hold. Their "omission" does not imply that such objections can not be made, but only that in the opinion of the writer they can be satisfactorily answered. In the present case the passages were not quoted, because they appeared trivial. My critic may hold that so far from being trivial they are weighty and even decisive. The reader may judge. Professor Lovejoy says: "H. in plain terms



describes the Naassenes as Christians." He does indeed quote a Naassene writer as saying: "And of all men we Christians alone are those who in the third gate celebrate the mystery etc." (V, 9). But what of it? *When* the Naassenes assumed this name is not said, not hinted, neither do we know how old is the name itself. It may very well be pre-Christian. There is in fact a double reference in the word Christian, to which I had never supposed it would be necessary to advert, namely a chronological and a dogmatic reference. Chronologically Christian refers definitely to the year 1 of our era and later; before the beginning of that year, everything was pre-Christian. Dogmatically it refers to the general thought-content of the propaganda that has spread over Europe and America. This Christian content, I contend, was in large measure pre-Christian in time. The Naassenes might have called themselves Christians before A. D. 1, though I by no means affirm that they did so. "Christians" (i. e., Christ-servants) may have been one of their later names.

Professor Lovejoy continues: "They are classified as a 'heresy.'" This has no significance, no evidential value. "Heresy" simply meant sect, school, set of philosophic or religious principles, and there is no reason for supposing that heterodoxy must be later than orthodoxy. In my judgment the heresies were not in general deviations from existent orthodoxy; on the contrary, they were *more ancient* forms of faith, which orthodoxy had outgrown and left behind; just as errors in syntax and pronunciation are very often only elder correct forms of speech, which the language has at last rejected.

Professor Lovejoy again: "They traced their doctrine "through Mariamne to James, the brother of the Lord"—which of course, shows them not only Christian but also at earliest of the first or second generation *after* the Apostles." "H. plainly and consistently describes them as a late first-century or second-century school." Indeed! So then they were at earliest near the beginning of the second century! It is hard not to smile at the naïveté of these deliverances. Of Mariamne we know little or nought. Origen indeed speaks of the followers of this shadowy character as mentioned by Celsus, but himself had met none of them (C. C. V. 62). But "James, the brother of the Lord"! Here Professor Lovejoy assumes the whole point in controversy. If James was really the flesh-and-blood "brother of the Lord" (i. e., of Jesus), then the book reviewed was not worth reviewing. But can it be that any one really attaches

weight to this expression, even when strengthened by the prefix "twin"? Least of all men does Professor Lovejoy need to be taught about kinship in the Orient. Who can forget the answer of this same "Jesus" to the question "Who are my brethren"? How "looking round on them which sat round about him, he saith, Behold, my mother and my brethren! For whosoever shall do the will of God, the same is my brother, and sister, and mother." It would be hard to imagine a passage more thoroughly in accord with the contentions of the work reviewed. In Matt. xxviii. 10 the same Jesus says "Fear not; go, announce to my brothers." And in John xx. 17 "Go to my brothers and say to them," clearly meaning disciples. Jerome understood the matter better, for he says, commenting on Gal. i. 19, "James was called the brother of the Lord because of his great character, his incomparable faith, and his extraordinary wisdom." The Epistle attributed to James shows not the faintest trace of blood kinship with Jesus, in fact *nowhere suggests the New Testament story*, but expounds solely the philosophical morality of the Dispersion. As well might one think of Epictetus or Marcus Aurelius as of its author as consanguineous with Jesus. The phrase "Brothers of the Lord" seems to be merely one of a score of names borne by groups of early propagandists. As such a class name it appears in 1 Cor. ix. 5, "The Apostles and the Brethren of the Lord and Kephias." We need not then "strike out" anything "from Hippolytus's text"; these "numerous passages" are not "unfavorable to the theory of a pre-Christian Jesus." But even if they were, what would it signify? Simply that H. himself did not embrace that theory, that he occupied the modern standpoint of Professor Lovejoy. And doubtless he did. Like Epiphanius and all the heresiographers he was an Old Catholic and held fast to the view established against the "heretics" in the second century and prevalent to-day. Even had he explicitly declared the Naassenes were post-Christian in origin, it would not matter; for he would merely have been expressing what *must* have been his faith, whether with or without evidence, whether consistent or inconsistent with acknowledged facts. The truth is, all the heresiologues are special pleaders. They *had* to make out a certain case against the "heresies"; they *had to post-date* them, in order to uphold their dogmas. It made no difference that unmanageable facts embarrassed their faith; the more intractable the fact, the more steadfast their faith; with Tertullian they cried out, "I believe it, because it is impossible." Hence the deliberate statements of these excellent men regarding heresiarchs and

their dates count but for very little, being divided by such a large factor of prejudice. All the more heavy do their unthought statements fall into the scale. Their unmeditated words are also unmedicated. It is these we are to heed most closely, from these we must draw out the implications of which the authors were unconscious. It was Thenius (I believe) who shrewdly said of a datum given by Josephus: "This statement appears to have been made incautiously; we may therefore accept it as correct." Professor Lovejoy smiles at "the humorous idea of a conspiracy of silence about the Nasaraioi"; but why should such a conspiracy be more unlikely in the third century than in the twentieth? It would imply only a general motive operating on the writers: a bewilderment as to how to deal with these ancients,—a bewilderment manifest enough among moderns also.

Now let us see how the whole representation of H. impresses a competent English specialist certainly orthodox enough to please Professor Lovejoy. Speaking of Hippolytus on Justinus, Dr. Salmond says: "What H. here states respecting Justinus is quite new. No mention occurs of this heretic in ecclesiastical history. It is evident, however, that, like Simon Magus, he was contemporary with St. Peter and St. Paul [an *elder* contemporary according to Acts viii. 9,—W. B. S.] Justinus, however, and the Ophitic sect to which he belonged, are assigned by H. and Irenæus a prior position as regards the order of their appearance to the system of Simon, or its offshoot Valentinianism. The Ophites engrafted Phrygian Judaism, and the Valentinians Gentilism, upon Christianity; the former not rejecting the speculations and mysteries of Asiatic paganism, and the latter availing themselves of the cabalistic corruptions of Judaism. The Judaistic element soon became prominent in successive phases of Valentinianism, which produced a fusion of the sects of the old Gnostics and of Simon. Hippolytus, however, now places the Ophitic sect before us prior to its amalgamation with Valentinianism. Here, for the first time, we have an authentic delineation of the primitive Ophites. This is of great value." We need not accept all that Dr. Salmond here says. Some of his constructions may be faulty; the important fact is that he states unequivocally that Justinus was contemporary with St. Peter and St. Paul, and that Hippolytus and Irenæus assign him a "position prior to the system of Simon," himself prior to the preaching of Peter (Acts viii. 9). Here then Dr. Salmond ranges himself squarely against Professor L. in the matter under debate. What Dr. Salmond

neglects to state is that H. writing of Justinus declares that "all these style themselves Gnostics in the peculiar sense that they alone have drunk down the marvelous Gnosis of the Perfect and the Good." Here then was a Gnostic *prior* (according to H.) to Simon Magus (who was at the latest contemporary with Sts. Peter and Paul), hence in the first half of the first century; moreover he was an Ophite, a Gnostic, full-fledged. Moreover he is placed by this same H. after the Sethians, and these after the Peratae, and all these after the Naassenes, the Ophites proper, the first who sur-named themselves *Gnostics*. These latter facts are no less important, indeed far more important, than the ones that Dr. Salmond emphasizes, which by themselves are enough to upset Professor Lovejoy's contention completely.

If then I am at all capable of comprehending chronological combinations, I must hold unshaken the positions of *Der vorchristliche Jesus* with regard to H. It should be added that the chronological order given by H. is fully confirmed by analysis of the various doctrines, that of the Naasseni showing itself to be obviously the most primitive. No one, however, would insist upon the particular order of the middle terms, Peratae, Sethians, Justinians, who may well have been nearly contemporary.

II. With regard to the testimony of Epiphanius it seems sufficient merely to refer to the passages quoted in full in *Der vorchristliche Jesus*, as a correction of the representations of the review. The reader may judge for himself. So far as the general opinion of reviews would seem to go, there is but one escape from the conclusions of the text: to deny outright that Epiphanius knew what he was talking about. The desperation of this last resort needs no comment.

III. With regard to ἀνίστημι and ἀνάστασις Professor Lovejoy is at pains to show that the former is used classically to mean "restore to life."

"Thou say'st an undisputed thing  
In such a solemn way."

The same is distinctly recognized in *Der vorchristliche Jesus*. The passages referred to by Professor Lovejoy (I. 24, 550-551), Agam. 1361, Electra, 139) were not mentioned, nor Eur. H. F. 719, more apposite though uncited by Steph. or L. and S., because the discussion was not about ἀνίστημι but about ἀνάστασις. It was not questioned that "raise up" might be applied to the dead, indeed such an occasional use seems almost inevitable; not quite so, however,

the use of "raising up" as the technical term for resurrection from the dead, though this sense was also admitted as "perhaps known from the earliest times." In fact the actuality of the double use was well-nigh essential to the argument of the text. The verses, Is. xxvi. 14 and Job. xiv. 12, mentioned "as pertinent passages our author likewise neglects to quote," are caught by Professor Lovejoy in a net as fine-meshed as a Pasteur filter. "Dead, they shall not live; shades, they shall not rise" (Is. xxvi. 14): "So man lieth down and riseth not" (Job xiv. 12). Such a use of the Kal future of *qûm* in the commonest sense of *rise up* was surely not under consideration. That the rising is from the couch of death, is given only by the context. The passages have no logical pertinence. If such must be cited, what can be omitted?

Professor Lovejoy thinks the linguistic argument wholly without valuable results, in striking contrast with a pre-eminent Biblical scholar in England, who declares that "though exceptions may be taken to some details of the argument, a *prima facie* case is certainly made out." Perhaps it may be well to recall the logical movement, which can hardly be detected in Professor Lovejoy's comments. The reader will find the situation summed up on pp. 81-82: The preachers in Acts use uniformly terms that might indeed mean resurrection (from the dead), but to their hearers at least meant much more naturally and familiarly quite another thing, namely, establishment. They spoke in the same breath of "raising up David" and "raising up Jesus." It would be strange if under the supposed conditions they indulged in an unnecessary pun. They also certainly spoke of this "raising up of Jesus" (Acts iii. 22, 26; xiii. 33) in the sense of establishment; strange that they should also use it then originally in a sense entirely different. Also the text criticism shows that the phrase "from the dead" is in many cases loose and uncertain and bears strong internal marks of being an insertion.—But this linguistic argument does not stand alone. It is confirmed by the second half of the essay, which even critics who reject the first half find very significant. The argument must be judged as a unit. In fact, the whole argument of the book is cumulative. It must be answered, if at all, in its entirety, not merely in this or that detail.

IV. The case of Apollos has proved a veritable *crux* to the critics of *Der vorchristliche Jesus*. Nearly every one adventures a solution of the difficulty, no two the same solution, and no solution at all acceptable. Loisy, in reviewing *Der vorchristliche Jesus*,

concedes the inadequacy of all solutions and admits (*il faut admettre*) that the primitive preaching must have taken place under forms more various and conditions more complicated than hitherto supposed. This concession seems to me to go very far, much beyond what Loisy intended. Clemen takes the bull by the horns, frankly declaring that the author of Acts must have erred. Soltau admits that the reference in τὰ περὶ τοῦ Ἰησοῦ must be to the *cult* (*Religionsanschauung*) and not to the historic content of the life of Jesus. Into this list of warring explanations Professor Lovejoy's may enter with the rest. To my mind it goes far aside into irrelevant matters, leaving the knot of the difficulty untouched. It is at best what a chemist might call a 2% solution.

In conclusion, let me reiterate that the argument of the book cannot be judged save by the laws of cumulative evidence. It is the *whole* body of facts adduced that must be adjusted into some self-consistent scheme of interpretation. We must restore in thought the unity and coherence that undoubtedly bound them together originally. Nor let any one imagine, as does Professor Lovejoy apparently, that practically the whole body of evidence thus far accumulated or at least the most important elements have been presented in *Der vorchristliche Jesus*. That work was in fact a reconnaissance in force. The mass of evidential matter already gathered is three or four times as great and in my judgment has independently even greater demonstrative power. Of course, the examination is not yet complete; in the nature of the case it cannot be completed, but it seems to have gone far enough even now to indicate clearly that (to quote a distinguished British scholar and philosopher) this new "conception of the *Origines* of Christianity is in the main on right lines."

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#### THE FUTURE OF ARTIFICIAL LANGUAGES.

I am somewhat at a loss to understand why any Monist does not readily grasp the idea of an auxiliary international language, for I read:

"Monism is a unitary conception of the world. The world must be conceived as one inseparable and indivisible entirety. It admits of a constantly increasing realization and of a future perfection. The monistic idea of a unitary conception of the world

has been constantly corroborated by the progress of science," etc.—*Primer of Philosophy*, pp. 4-5.

But I take it that the able advocate of monism has no quarrel with the adoption of some "natural" language, preferably English, as an international medium, but rather questions the necessity or feasibility of an artificial language and prefers the more comfortable rôle of a spectator merely.

Let us first examine such claims for the English for a brief space and see where we may arrive, prefacing my remarks with the assertion, that, personally, I would look upon the universal adoption of any existing language as almost in the nature of a calamity, while admitting the progress English has been making.

Not touching here upon its irregularities or whether the Mohammedans can ever be induced or compelled to accept it, the illogisms of our really great mother tongue are almost intolerable to any one aiming at clarity of thought. For example, we say "the sun is rising" or "is setting" when it is the motion of our own planet that has deceived our senses. We say "I am disgusted with" when we really mean at, or from, or against, and a very recent account in a local paper describes the distressing accident to a Scandinavian carpenter working in the lower story of a mill under construction. When he heard the cry "Look out!" of some men canting a log above, the unfortunate man literally obeyed by thrusting his head out of a window, and as a result was practically decapitated. But why continue, for I know that French and assume that every other existing tongue, have such, or greater crudities, yet none such could be tolerated in any well-constructed artificial language, for example, like "Ilo" (the latest evolution of Esperanto, as simplified and reformed), and a greater familiarity with either of these systems must explain any preference for exemplifying them herein.

Again, how many words we often have to use for expressing a simple idea when one appropriate word should suffice, as *pen-valarar*, "to be worth the pains." When the child was asked "Have you a good memory?" and he truthfully and logically answered "No, but I have a bad *forgetency*," he was considered both amusing and original, yet I have often thought that if we could have a competent and authoritative academy (as indeed most artificial languages have) for our own tongue, it might possibly be able to do something in the way of correcting our illogisms, modify many of our irregularities and improve our phonology; but I fear this would be expecting altogether too much, as most living or natural lan-



guages become too stereotyped and there is generally much prejudice against all innovation.

Such an academy might also by precedent sanction such words as "criticable," "makeable," "hopeably," "fixable," "elsewhen" (elsewhere), "farness" (nearness), "outgo" (income), "beginningless" (endless) and many other apparently strange but useful forms, but the idea perhaps is utopian. Yet the man in the street readily assimilates such neologisms as "plunderbund," "talkfest," "brainstorm" and the like, for he is above all things a practical fellow who never mistakes a bath sponge for a sponge bath, a houseboat for a boathouse or a billboard for a boardbill!

Now, in Ilo and Esperanto we have all such ideas as the foregoing, with a very great number more, neatly and accurately expressed, at least in the first named system, for it has borrowed the conveniences of six of the greatest living languages—German, English, French, Italian, Russian and Spanish, (the DEFIRS which its dictionary appends to a root), while ignoring their shortcomings.

Thus (and this I consider to be almost the crux of the whole question, the very marrow in our bone of amicable contention), on the basis of "the maximum of internationality," the Ilists select a "root" that is common to the greatest numbers of millions, when they can, by "word-building" with one or two of the well-defined affixes or "exponents," carry it to its fifth, tenth and even twentieth "power," each expressing a different shade of meaning and without materially increasing the root's length. I ask, can the same be done with any word in English, or any other known tongue?

Let us take the international  $\surd$  *futur-* which can also be found in such non-Romanic tongues as German and Russian, and we build *futuro*, the noun; *futura*, the adjective; and *future*, the adverb "futurely," which last form the English lacks, while the same form must serve for both its noun and adjective.

Again, touching now upon the feature of brevity with clarity, take the lengthy name *United States of (North) America*, and *Usono* is understood by Esperantists and Ilists alike, while *usonano* gives us the inhabitant or citizen thereof exactly, instead of the altogether too generic term "American," who may really be a native of Canada or any of the South American republics. So Ilo is a contraction of *internaciona linguo* and happens to mean, appropriately enough, an "instrument," with many derivatives therefrom. But this method of monogrammic abbreviation is used sparingly.

Now, without going into the defect of our many homonyms



like peace and piece, pain and pane, a defect also common to other natural languages and which is of course eliminated from an artificial one, much as artificial teeth successfully replace bad natural ones, let us here state a few postulates now generally accepted by all students of this latest branch of philology, the artificial—of which Dr. L. Couturat and his confrere, Dr. Leau, are undoubtedly the greatest living authorities and historians, and to whom, with de Beaufront, "the father of Esperanto in France," we are largely indebted for the later product, Ilo. Philologists now generally concede:

1. That all artificial languages are secondary to, and are never intended to supersede the mother tongue.
2. That the primary use of any artificial language is for commerce, science and travel and that it is as yet premature to attempt any literary efforts or translations (although I am aware the Esperantists have disregarded this rule).
3. That such artificial language should be founded on an *a posteriori* basis and not an *a priori* one (i. e., we should draw material from existing languages rather than coin previously unheard-of words, like those composing Zamenhof's correlative table).
4. That a good artificial language, constructed with the "maximum of internationality," can be learned with advantage by young and old, as laying a foundation and easy entrance to many other languages, living or dead.
5. That the analytic is preferable to the agglutinative form.

To these postulates I should add the formula found by that clear-thinking Dane and great philologist, Prof. Otto Jespersen, who has since laid down the axiom (the original is easily read): "La max bona linguo internationa esas ta, qua prizentas la max granda facileso por la max multa homi," and, anticipating the inquiry, will state that the foregoing is in neither Latin nor Danish, Italian nor Spanish, nor yet Esperanto.

Religion is much akin and only comes secondary to language, and who has counted the number of systems of the former that have been *created* and flourished? And naturally any such *bela ideo* as Esperanto, like a religion, attracts many idealists and possibly a few intolerant or mediumly-educated people, mostly monoglots with a growing knowledge of their idol, for which they too often make the most extravagant and preposterous claims.

Yet there are many notable exceptions, like the veteran Richard

H. Geoghegan of Fairbanks, Alaska. Only a few of his intimate correspondents know of the profound learning and very great linguistic attainments of this modest and versatile man, with whom it seems to be a recreation to study another language about every three months and who has done an immense amount of correspondence in Esperanto since 1889, with Jón Jónson of Iceland, M. Bourdaloue of New Caledonia and with many others as widely distributed, all tending to show how much can be done with an international language and that the idea is becoming a practical reality.

I cannot agree with Dr. Carus that "irregularities originate according to our needs"; rather do they grow according to our elemental minds or our slovenly habit of thought. Granted that "artificial languages would soon introduce certain irregularities," yet they would only be local or at most national departures from the standard of purity and excellence laid down by their Academy or Fundamento (which latter is like the Koran to the Arabic).

True, as Dr. Carus intimates, we may not have attained the ultimate, for if we had, we would at once commence to retrograde and decay; our product is "not perfect, but always perfectible." But the Delegation which met at Paris in October, 1907, for the adoption of some international language, laid a very solid foundation when, of the many systems presented, it accepted Dr. Zamenhof's creation, but subject to the modifications proposed by de Beaufront, Couturat, Jespersen and others, and which have since been incorporated and appear in its organ *Progreso*.

Possibly some great Oriental linguist, as yet unborn or now in the infantile dairy business, may some later day arise in his might and smite us on the ground that Ilo is altogether too European, but are we meantime to stand idle in the event of such a remote contingency? That would certainly not be progress, and he would surely be welcome to the laborious task of building an Asiatic rival, with Arabic-Hindustani-Chinese roots.

I can barely touch upon the inestimable scientific value of an international language, with a terminology constructed by specialists and acceptable to all scientists, nor what an instrument it will be as making for peace and righteousness. As I look across my desk I see several pigeonholes containing letters from various parts of the world, written clearly and concisely in an apparently strange idiom, yet one that seems far more flexible than my own great tongue, as euphonious as Spanish or Italian, phonetic, legible and brief; and I venture to assert that not one of your readers, be he of

English, French, Spanish or Italian extraction, will fail to almost instantly understand the following short specimen:

"La establislo di la internaciona linguo tute ne esas verko di personala inspireso, fantazio od arbitrio, sed verko di cienco e di pacienteso. Ni ne pretendas a neeroriveso e ne konsideras nia verko quale ideala. Ol esas simple verko di cienco, di koncienco e di bonvolo. Nia verko ne esas certe perfekta; sed, quo forsan plu valoras, ol esas sempre perfektigebla."

In conclusion I must agree with Dr. Carus that the Esperantists at least have perhaps been far too hasty and over-anxious, and I must plead guilty as having been one of them. Certainly many of them have shown an unreasoning antagonism to even the most essential changes and reforms. When the Doctor suggested a system of pasigraphy some years ago, he did not attempt to force its acceptance, assert that it was "untouchable" or make any extraordinary claims for it. Nor yet, on the other hand, did he then raise any question as to its cerebral receptivity or acceptance through the optic instead of the auditory nerve! But why did he not suggest an already existing pasigraphy like the Chinese? And the anticipated answer that it is too cumbersome and unsuitable for international usage will also apply, with but slightly lesser force, to English or any other naturally evolved language.

And finally I ought not perhaps to forget a word of commendation for Mr. Strauss's able and impartial argument, not forgetting to add, however, that M. Bollack has since given up any attempt to propagate his own system and thrown his forces with the Ilists.

ALEXANDER H. MACKINNON

SEATTLE, WASH.

#### A DEFENCE OF INTERNATIONAL LANGUAGE.

In the October issue of your magazine you propose to have the problem of an artificial language discussed, and you proceed to express yourself adversely, while Mr. C. T. Strauss defends it, though, according to his own admission, rather from the point of view of a theoretical observer than as a practical adept of one of the many international language systems. Permit me to answer some of your criticisms, and to supplement the remarks of Mr. Strauss by some observations gathered from two years' study and practical use of Esperanto, both in its primitive and in its new and simplified form ("International Language of the Delegation," "Ido" or "Ilo").

You consider more or less complete reforms in spelling and even in pronunciation as much easier to introduce than an artificial auxiliary language. You are willing to give the artificial language makers and adepts a chance to show what they can accomplish, but you believe that the life-time of one generation will not suffice to realize the problem. The friends of the artificial language idea are of the opposite opinion: they favor an artificial language because they think that it could be introduced within fifteen or twenty years, while fifty years would hardly be enough to make the Anglo-Saxon public of the old and new worlds accept even so comparatively slight shortcuts in their orthography as *ar*, *det*, *dum*, *fisic*.

Your criticism seems founded, in part, on the high office you attribute to such a language. Simplicity, indeed, cannot be a leading feature of a tongue that is to be adapted at a time to commercial relations, scientific communications, and literature in all its phases. This just objection cannot be too energetically repeated to the Esperanto fanatics who, with their leader Zamenhof at the head, insist upon squeezing works like "Iphigenie" of Goethe into the Procrustean bed of their 1000-root language (for the other 4000 or 5000 roots in Esperanto translate purely technical expressions).

You find that irregularities would result from an introduction of the language into the living practice, as the public would soon begin to contract inconveniently long forms. This consideration can only stimulate the makers of artificial languages to give their output a high degree of brevity and simplicity from the outset. The remodeling to which the Parisian committee subjected Primitive Esperanto in October of last year has been largely necessitated by a series of *a priori* forms, chosen arbitrarily by the inventor, and which have proven themselves a hindrance in the practice. At the same time, the principle was laid down that no artificial language can claim an absolute intangibility as to some of its parts, such as was proclaimed by the Esperantists in 1905, chiefly at the behest of commercial propagandists. A competent authority must be entrusted with the right to introduce further improvements, both additions and simplifications, and to guide the blind usage, which has during the last few years engendered in Esperanto a large number of anomalies. Your remark that irregularities in a language spring from abbreviations of speech, while it is correct to a certain extent, does certainly not apply to all cases. The forms *spring*, *sprang*, *sprung*, for instance, which in German grammar are called strong, i. e., regular verbs forming a class of their own, are in English grammar ordi-

narily classified as irregular; and this classification can be justified when bearing in mind that there is hardly one verb of this type to a hundred verbs of the type *jump*, *jumped*, *jumped*. This latter type has now become practically the norm and is still absorbing gradually verbs of older formation. The Academy of the International Language can prevent such apparent anomalies by foreseeing how unwise it would be to use variation of a median sound in a verb as a means of distinguishing tenses; for the unnecessary restriction in the choice of roots which would follow from the adoption of this plan would soon lead in practice to the parallel of a second and less cumbersome form. A well-formed artificial language will degenerate much less through usage than a national language, and the cases where difficulties occur will have to be handled on their merits by a competent body.

You suggest that the reformers should improve one of the existing languages, instead of making a new one. Here you have by independent reflection arrived at a conclusion which the Esperantists (at least those that are honest with themselves and others) have learned through practice. *A priori* language making has now been discarded to such an extent that even the free selection made by Dr. Zamenhof of many German or Slavonic roots (for instance *vosto* "tail," should be *kaudo* which occurs as a root or as a word in English, French, Italian and Spanish; *tago* "day," should be *dio* E. I. S.; *taugi* "to fit," should be *konvenar* E. F. I. S.; *varbi* "to recruit," should be *rekrutar* German, E. F. I. Russian, S.) has been absolutely rejected. The international vocabulary must be the easiest possible for the greatest number of men, hence a root known to 180 million people is to be preferred systematically to one known by 100 million.

The next requirement is that these roots must be capable of developing the needed derivatives according to a uniform system. Here again is a principle which is found in germ in Primitive Esperanto, but is recognized to its full extent only in Ido. Several suffixes have been added; the more or less confused use of the old ones has been regulated; a number of faulty derivatives or of awkwardly lengthy forms have been replaced by new roots of international character. In your former article, of October 1907, you very justly pointed out the dangers that could ensue from a dilettant handling of the word-building material contained in Esperanto. Now precise rules for derivation have been laid down in the grammars, so that competent persons are able to form correct and clear derivatives in those cases where the amplified vocabulary does

not furnish simple roots. Persons of a less logical turn of mind are referred to the dictionaries, manuals or usage for acquiring their vocabulary. No language, whether artificial or natural, can do more; but to invite writers to form such expressions themselves, according to their best ability and without fixed principles, such as Primitive Esperanto has done heretofore, is to bring sure complication and ruin on the language.

Is it possible, then, with these great guiding principles of internationality and logical construction, to form a language that is above attack in all details? Perhaps not: ordinary common sense, rather than science, will, after all, have a small share in the fixing of the alphabet and of the grammar. Here simplicity must govern, and there may be some difference of opinion as to what is absolutely required and what not. Still, the most recent language projects do not differ widely on these points; so it seems the rejection of unnecessary complications cannot be carried much further. There must be no letters that are not in the Roman alphabet; there must be no sounds that would be difficult to several important nations; there must be no difficult combinations of sounds; there must even be euphony; and the grammar must be rather on the English type with logical word order, without an accusative and without an inflected adjective, than on the German type, with cumbersome declensions and syntax. It will be found especially difficult to choose the pronouns so as to please everybody.

Still, these minor points cannot be regarded as serious obstacles to the scientific, rather than the empiric solution of the problem. Jespersen has now given up entirely the Platonic attitude that you ascribe to him about the subject, and has treated on the above outlined topics in articles written in Ido itself, which have been published during several months in our monthly *Progreso*. He has also written the preface for the Ido-national dictionaries. Bollack, whose system Mr. Strauss is inclined to prefer, has laid aside his own work and is now with characteristic enthusiasm and generosity propagating Ido. He is, indeed, almost the only one of the inventors who has shown this latitude of spirit. For instance, Molenaar protests vehemently against Ido and continues to expound the advantages of his pan-romanic "Universal," which consists exclusively of ready made words adopted as they stand, is quite irregular in its vocabulary for any one who does not know a Romance language beforehand, and is dependent in all its details upon constant borrowing from living languages. Another group of language makers is now

perfecting the "Idiom Neutral" with the aim to produce a language that excels less for European internationality, systematic rules for derivation and extreme simplicity of grammar, than for its aspect of a living Romance tongue—as if a philologically revised New-Latin were not still far too complicated and idiomatic for general use! Aside from these systems on European and on Romance bases, there is at least one project based on the pure Teutonic and even one based on the Greek vocabulary.

On the other hand, many Esperantists, with their leader Zamenhof at the head, claim that science has nothing whatever to do with the problem, which according to them is a purely dynamic one: the language that is most thoroughly advertised and consequently attracts the most attention among the general public, has the best chances for success. This is true to quite a large extent, but still not so exclusively as the ordinary run of commercial propagandists of Esperanto believe. It would rather seem that an enthusiastic propaganda is possible only where the conviction as to the intrinsic merits of the propagated language is genuine. The rapid falling off in the number of adherents of Primitive Esperanto during the last four months, especially in Germany, is ample proof of this fact. The attempts of the Esperantists to make an impression by their noisy yearly congresses promise little for the future, since the city of Dresden became one of the centers of the Ido movement, just one month after seeing the enthusiastic gathering of the orthodox Esperantists last August.

Considering the mental capacity of its adherents, Ido seems now to have a fair lead over the competing systems. It is the aim of the movement to persuade inventors of other systems, as well as men of science who are interested, to take a seat in their planned academy and thus profit by their labors in further developing the language according to the established principles. It is not unlikely therefore that the preponderance of Ido will soon become overwhelming and that the followers of Zamenhof will have to make peace with the new system as best they can. While unity among the advocates of the international language idea seems still far off, the prospects are not discouraging. Granting that many details in Ido, especially those that relate to phraseology, are still to be settled more definitely, why should it not be possible in time to have the Ido academy replaced by an international commission, appointed by the different governments? And why should not the governments then recommend and even require a knowledge of the international language for certain



purposes? The impetus thus given to this language would soon be a powerful incentive for the general public to acquire a knowledge of it. I cannot possibly see why an international idiom thus acquired should, for the person using it, differ from any natural foreign speech that he has learned, except in this that the artificial language requires as many months as the other requires years to acquire. I can, from my own experience, testify that I learned to use Esperanto in conversation with what I consider a high degree of ease and fluency within five months, more so in fact than I succeeded with the English language within the same number of years, although, as a born German, I am by no means raw in languages, in fact have a fair degree of fluency in the oral use of four of them and a reading and theoretical knowledge of a number of roots.

The international language is certainly much more artificial than even literary German, but still it seems to me to be less artificial in its application to modern topics than classical Latin would be. It is and will be, according to the express declaration of its promulgators, "never perfect, but always perfectible." It should not be expected to compete with our national languages in wealth, for then it could no longer be simple; but on the other hand it aspires to a high degree of preciseness. As Ido has over Esperanto the great advantage of legibility at first sight, and over the other systems that of a vigorous propaganda, it takes no great gift of prophecy to foretell that it will spread enormously within a few years. It will be highly interesting to observe to what extent the practical application of this language in many provinces will refute the *a priori* objections of the majority of the scientists.

O. H. MAYER.

CHICAGO, ILLINOIS.

#### ESPERANTO, ILO AND MALAY.

Concerning the establishment of an international language, we have so far preserved a neutral attitude, because we bear in mind that a language is comparable to living organisms, and it would be as easy to construct an ideal plant as to produce an ideal language. Languages grow just as plants and animals. A language does not consist merely of words that are printed in dictionaries, but exists in the living brain-structure of the people who speak it. I do not argue against the theoretical possibility of constructing an ideal plant or an ideal animal, or even a homunculus after the fashion



suggested by Goethe in the second part of *Faust*, but practically I deem such undertakings as Utopian, and it will always be easier to modify existing organisms than to construct new ones. All artificial languages have so far shared the same fate of being at the beginning enthusiastically hailed by a number of adherents, but when the attempt was made to have them spoken, the difficulty began. Those who speak the language soon disagree and without any effort of outside circles the two or several parties of its adherents disintegrate the movement and very soon it dies a natural death. Such was the case of *Volapük*, which created an enormous sensation at the time when it first made its appearance, but when it reached the height of its fame a strong reform party proposed improvements which were met with the bitter resistance of the founder and his immediate friends.

The same fate seems to repeat itself with *Esperanto*. We cannot judge whether the reformers who propose a language called *Ido*, or the original *Esperantists* are to be favored, but will only present the facts of both sides. In a recent report of the Fourth International Congress of *Esperantists*, in the middle of August, 1908, the following statement by Herr von Frenckell was read:

"Die *Esperantisten* wissen, dass sie uneigennützig ihre Arbeit der ganzen Menschheit zum Wohle stellen, und sie ertragen deshalb ruhig die immer noch recht häufigen Einwendungen der Zweifler an ihrer Sache. So konnte der Kongress auch einmütig sich gegen alle Veränderungen in der Sprache aussprechen und eine Akademie für die einheitliche Weiterentwicklung ihrer Sprache wählen zum grossen Verdruss einer kleinen Reformpartei, die rein persönliche Interessen einiger einzelner verfechten möchte. Auch aus dieser Schwierigkeit werden die *Esperantisten* siegend hervorgehen. Die sorgfältig versteckten sprachlichen Fehler, welche die *Reformsprache* enthält, sind aufgedeckt worden, so auch vor allen Dingen die scharf verurteilungswürdigen Manipulationen der Urheber der Verschlechterungen, Reformen genannt. Somit ist es anzunehmen, dass auch die nächstjährigen Kongresse die Einheitlichkeit von neuem betonen werden, sofern die Reformer es nicht vorziehen wollen unverstanden jährlich eine neue Sprache zu erlernen."

In this connection I will make a statement that may be surprising to many. While traveling through Europe last year I met a Dutch gentleman born and raised in Java. He is a lawyer by profession and if I mistake not has large business interests in the Dutch colonies. While discussing the problem of an international

language, he offered with great seriousness the proposition that in his opinion the introduction of Malay as a world-language would be the best and most practical way to do away with further vain attempts at constructing an international tongue. He said—and was positive about the correctness of his statement,—that Malay is the easiest language to acquire, that no language, natural or artificial, would be simpler in its construction or more easy in pronunciation, that it could be learned without effort of any kind, and in addition was spoken by many millions of people throughout the East Indies. It is ready made and has passed through a course of experience by practical use throughout the Dutch colonies, and Esperanto in its original and its reformed Ido are by far more difficult and complicated.

EDITOR.

#### EXPERIENCE DE DOUBLE TRADUCTION EN LANGUE INTERNATIONALE.

Beaucoup de philosophes croient encore que, si la langue internationale peut bien servir aux besoins de la vie courante ou même des sciences exactes, elle est incapable de rendre avec quelque précision les pensées philosophiques. Pour mettre la langue internationale à l'épreuve dans ce domaine particulièrement ardu, j'ai traduit trois morceaux philosophiques, un allemand, un anglais et un français, empruntés à trois auteurs illustres: MM. Gomperz, W. James et Poincaré; et pour que l'expérience fût plus probante, j'ai prié MM. Gomperz et James de m'indiquer eux-mêmes dans leurs œuvres le morceau qu'ils jugeaient le plus approprié à cette épreuve. De ces morceaux, le plus difficile, sans comparaison, était l'allemand, tant par la langue même (la plus malaisée à traduire en n'importe quelle autre) que par le style particulièrement élégant, littéraire et raffiné de l'auteur (*Vie et action de Socrate*, en *Griechische Denker*, tome 2, pages 36-41). C'est du reste ce qu'ont reconnu tous ceux à qui j'ai distribué ces trois traductions pendant le Congrès de Heidelberg (septembre 1908).

Or M. le prof. Pfaundler, de Graz, sans m'avertir ni me consulter, a entrepris de retraduire en allemand le morceau de M. Gomperz, dont il ne connaissait pas l'original, d'après ma traduction en Ido (nom conventionnel et provisoire de la *Langue internationale de la Délégation*). Je n'ai pas voulu voir sa traduction, et lui ai conseillé de l'envoyer directement à M. Gomperz (son collègue de

l'Académie des Sciences de Vienne). M. Gomperz lui a répondu comme suit :

"Suivant votre désir, je me suis empressé de comparer à l'original le morceau traduit d'Ido en allemand, que vous avez eu l'amabilité de m'envoyer ; et je l'ai trouvé étonnement fidèle dans l'ensemble. Les divergences très rares (une demi-douzaine en 5 pages de mon livre) sont imputables (si l'on peut parler de responsabilité en de tels détails) en partie à M. Couturat, et en partie à l'ambiguïté des expressions de l'original. Une fois vous avez employé une expression inexacte, par une distraction manifeste ; mais en aucun cas un reproche quelconque n'atteint la langue internationale. . . ." (Suit l'énumération des 6 erreurs).

"Je reconnais donc volontiers que cette épreuve a extraordinairement bien réussi, et que , pour autant qu'elle est probante, elle est favorable à un haut degré à votre opinion de l'applicabilité de la langue internationale."

(Signé) Th. Gomperz.

On doit remarquer que l'expérience n'a pas été faite dans les circonstances les plus favorables : le premier traducteur est philosophe, mais non Allemand ; le second est de langue allemande, mais non philosophe (physicien). Enfin le sens de certains mots techniques n'a pas encore été suffisamment fixé, soit par les dictionnaires de la L. I. soit par l'usage. Et l'original abondait en expression très littéraires et peu communes, comme : "anmasslicher Querkopf oder Besserwisser," "arbeitsscheuen Tagdiebes," qui sont presque des idiotismes intraduisibles. Il serait intéressant de faire une expérience analogue avec une traduction en langue nationale (par ex. avec la traduction des *Penseurs grecs* par M. Aug. Reymond) : il est probable que les divergences seraient bien plus nombreuses et plus importantes. Quoi qu'il en soit, avec les petites fautes qui en attestent la sincérité, l'expérience est entièrement favorable à la langue internationale. Nous remercions M. Gomperz d'avoir bien voulu nous permettre de publier son témoignage ; et nous espérons qu'on ne contestera plus désormais la possibilité d'exprimer ou de traduire avec exactitude, dans une langue internationale, les pensées les plus hautes de la littérature et de la philosophie.

L. COUTURAT.

P. S. Pour éviter toute fausse interprétation, nous tenons à spécifier que ce succès a été obtenu uniquement par la Langue internationale de la Delegation, élaborée par un Comité internationale de savants et de linguistes très compétants.

## A MAGIC CUBE OF SIX.

Probably it can be said with truth that the construction of magic squares and cubes has in itself no immediate utility. Benjamin Franklin, who devised some squares possessing remarkable properties, expresses himself as believing that he might have spent his time to better advantage, and the same thought has been uttered many times by others. As an intellectual recreation, however, and as a means of quickening one's insight into the properties and relations of numbers, this study has real value.

In an admirable work recently published on the subject of *Magic Squares and Cubes*, the author, Mr. W. S. Andrews, after developing very clearly the method of constructing magic cubes of odd numbers and of those divisible by four, passes over the problem of cubes of oddly-even numbers (6, 10, 14, etc.) as not yet solved, though he remarks that he does not believe them mathematically impossible. It was on his suggestion that my attention was turned to the question, and a method soon presented itself of attaining at least a partial solution.

In the first place six magic squares were constructed, exactly similar in plan except that three of them began (at the upper left-hand corner) with odd numbers, each of which was 1 or 1 plus a multiple of 36, and the other three with even numbers, each a multiple of 18. In the first three squares the numbers were arranged in ascending order, in the other three descending. The initial numbers were so

chosen that their sum was 651, or  $\frac{n}{2}(n^2+1)$ , which is the proper summation for each dimension of the projected magic cube. In the construction of these original squares, by the way, the diagrams devised by Mr. Andrews and presented in his book proved a great convenience and saved much time.

Each of the six squares so made is "magic" in that it has the same sum (651) for each column, horizontal row and corner diagonal. As the initial numbers have the same sum the similarity of the squares, with ascending arrangement in one half and descending in the other half, insures the same totals throughout for numbers occupying corresponding cells in the several squares; e. g., taking the third number in the upper row of each square and adding the six together we reach the sum 651, and so for any other position of the thirty-six.

In constructing our cube we may let the original six squares

III

57	179	178	39	176	42
174	44	172	171	47	43
168	167	51	52	50	163
49	53	165	166	164	54
48	170	45	46	173	169
175	38	40	177	41	180

II

198	20	21	196	23	193
25	191	27	28	188	192
31	32	184	183	185	36
186	182	34	33	35	181
187	29	190	189	26	30
24	197	195	22	194	19

I

1	215	214	3	212	6
210	8	208	207	11	7
204	203	15	16	14	199
13	17	201	202	200	18
12	206	9	10	209	205
211	2	4	213	5	216

VI

126	92	93	124	95	121
97	119	99	100	116	120
103	104	112	111	113	108
114	110	106	105	107	109
115	101	118	117	98	102
96	125	123	94	122	91

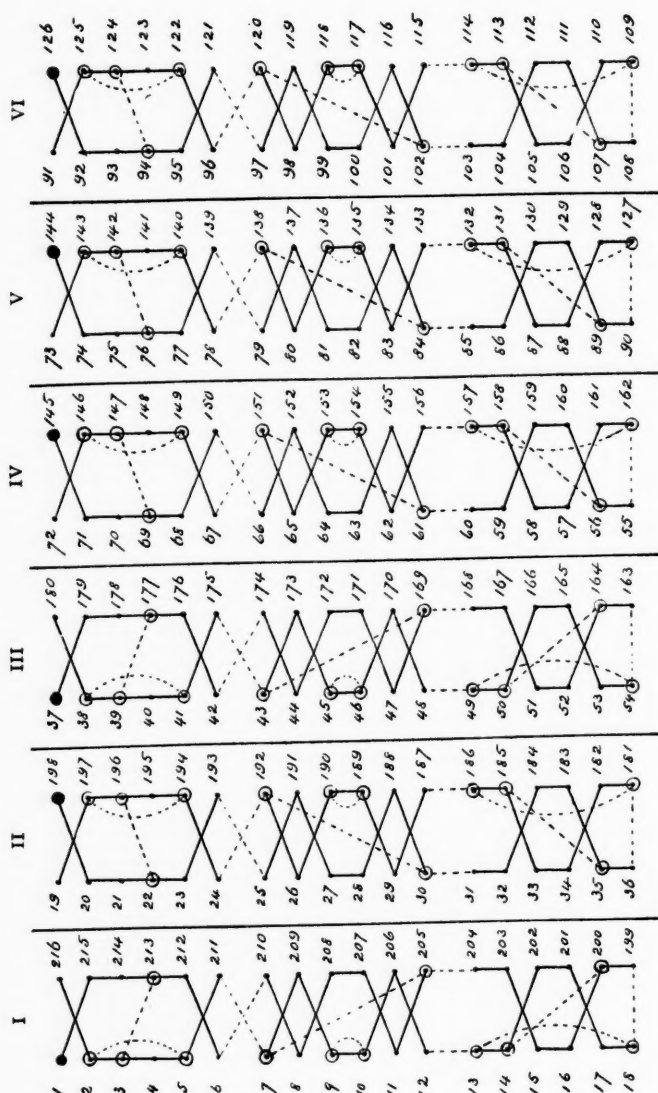
V

144	74	75	142	77	139
79	137	81	82	134	138
85	86	130	129	131	90
132	128	88	87	89	127
133	83	136	135	80	84
78	143	141	76	140	73

IV

145	71	70	147	68	150
66	152	64	63	155	151
60	59	159	160	158	55
157	161	57	58	56	162
156	62	153	154	65	61
67	146	148	69	149	72

Fig. 1.



serve as the horizontal layers or strata. We have seen that the vertical columns in the cube must by construction have the correct summation. Furthermore, as the successive right-and-left rows in the horizontal squares constitute the rows of the vertical squares facing the front or back of the cube, and as the columns in the horizontal squares constitute the rows of the vertical squares facing right or left, it is easily seen that each of these twelve vertical squares has the correct summation for all its columns and rows.

Here appears the first imperfection of our cube. Neither the diagonals of the vertical squares nor those of the cube itself have the desired totals, though their *average* footing is correct. It is true further that the footings of the two cubic diagonals originating at opposite extremities of the same plane diagonal average 651, though neither alone is right.

At this point, however, we come upon an interesting fact. While the cubic diagonals vary, the two half-diagonals originating at opposite extremities of either plane diagonal in either the upper or the lower face, and meeting at the center of the cube, together have the sum 651. These correspond in the cube to the "bent diagonals" of Franklin's "square of squares." Of course a moment's reflection will show that this feature is inevitable. The original squares were so constructed that in their diagonals the numbers equidistant from the middle were "complementary", that is, taken together they equaled 217, or  $n^2 + 1$ ,  $n$  representing the number of cells in a side of the square. In taking one complementary pair from each of three successive squares to make our "bent diagonal" we must of necessity have  $3 \times 217 = 651$ .

As in the Franklin squares, so in this cube do the "bent diagonals" parallel to those already described have the same totals. A plane square may be thought of as being bent around a cylinder so as to bring its upper edge into contact with the lower, and when this is done with a Franklin square it will be seen that there is one of these "bent diagonals" for each row. In like manner, if it were possible by some fourth-dimension process analogous to this to set our cube upon itself, we should see that there were six (or in general  $n$ ) "bent diagonals" for each diagonal in each of the horizontal faces, or 24 in all, and all having the same sum, 651.

The fact that each diagonal in the horizontal squares is made up of three pairs of numbers, each pair having the sum 217, suggests an interesting study. Figure 3 represents a vertical section of the cube in the plane of a diagonal of the upper face. The dotted lines

connect numbers, one pair from each of three rows, and in each case the sum of the six numbers is 651. The series represented in the figure—1 119 51 166 98 216, 1 112 8 209 105 216, 1 184 152 65 33 216, 8 126 130 87 91 209, 15 144 119 98 73 202—have each the same total, 651, and the lines connecting the numbers outline some graceful and symmetrical figures. Many more might be drawn, but these examples will illustrate the principle.

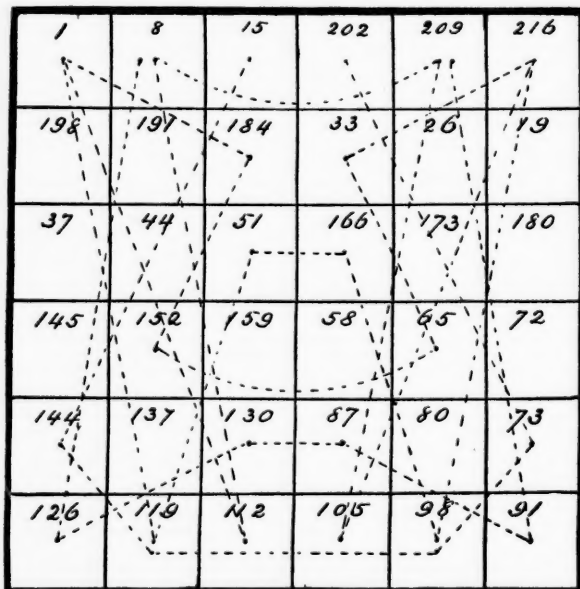


Fig. 3.

Omitting the series described in the last paragraph, which are rather fanciful than natural features of the cube, we may recapitulate the number of occurrences of the characteristic number 651 thus:

In the vertical columns .....	36 or $n^2$
In the rows from front to back .....	36 or $n^2$
In the rows from right to left .....	36 or $n^2$
In the diagonals of the original squares ..	12 or $2n$
In the cubic "bent diagonals" .....	24 or $4n$

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$$144 \text{ or } 3n^2 + 6n$$



The column of  $n$  values at the right represents the "general" numbers, found in cubes of 10, 14, etc., as well as in that of 6.

All these characteristics are present no matter in what order the original squares are piled, which gives us 720 permutations. Furthermore, only one form of magic square was employed, and Mr. Andrews has printed diagrams to illustrate at least 128 forms, any one of which might have been used in the construction of our cube. Still further, numerous transpositions within the squares are possible—always provided the vertical totals are guarded by making the same transpositions in two squares, one ascending and the other descending. From this it is easy to see that the numbers 1-216 may be arranged in a very great number of different ways to produce such a cube.

So much for the general arrangement. If we so pile our original squares as to bring together the three which begin with odd numbers and follow them with the others (or *vice versa*) we find some new features of interest. In the arrangement already discussed none of the vertical squares has the correct sum for any form of diagonal. The arrangement now suggested shows "bent diagonals" for the vertical squares facing right and left as follows: Each of the outside squares—at the extreme right or left—has four "bent diagonals" facing the upper and four facing the lower edge. These have their origin in the first, second, fourth and fifth rows moving upward or downward, i. e., in the first two rows of each group—those yielded by original squares starting with odd and those with even numbers. Each of the four inside vertical squares has but two "bent diagonals" facing its upper and two facing its lower edge, and these start in the first and fourth rows—the first of each group of three. This will be true no matter in what order the original squares are piled, provided the odd ones are kept together and the evens together. This will add 32 (8 for each of the two outer and 4 for each of the four inner squares) to the 144 appearances of the sum 651 tabulated above, making 176; but this will apply, of course, only to the cube in which the odd squares are successive and the even squares successive. As the possible permutations of three objects number 6, and as each of these permutations of squares beginning with odd numbers can be combined with any one of the equal number of permutations of the even squares, a total of 36 arrangements is possible.

While the straight diagonals of these squares do not give the required footing the two in each square facing right or left average

that sum: thus the diagonals of the left-hand square have totals of 506 and 796, of the second square 708 and 594, third 982 and 320, fourth 596 and 706, fifth 798 and 504, and the right-hand square 986 and 316, each pair averaging 651. I have not yet found any arrangement which yields the desired total for the diagonals, either straight or bent, of the vertical squares facing back or front; nor do their diagonals, like those just discussed, average 651 for any single square, though that is the exact average of the whole twelve.

By precisely similar methods we can construct cubes of 10, 14, 18, and any other oddly-even number, and find them possessed of the same features. I have written out the squares for the magic cube of 10, but time would fail to carry actual construction into higher numbers. Each column and row in the 10-cube foots up 5005, in the 14-cube 19,215, in the 30-cube 405,015, and in a cube of 42 no less than 1,555,869! Life is too short for the construction and testing of squares and cubes involving such sums.

That it is possible to build an absolutely "perfect" cube of 6 is difficult to affirm and dangerous to deny. The present construction fails in that the ordinary diagonals of the vertical squares and of the cube itself are unequal, and the difficulty is made to appear insuperable from the fact that while the proper summation is 651, an odd number, all the refractory diagonals are even in their summation.

The figures which accompany this article were drawn for it by Mr. Andrews, who has taken a lively interest in the cube and its properties. Especially valuable are the diagrams in Figure 2, showing how the numbers of the natural series 1-216 are arranged in the squares which constitute the cube. This is a device of Mr. Andrews's own invention, and certainly is ingenious and beautiful. The diagrams here given for squares of six can be expanded on well-defined principles to apply to those of any oddly-even number, and several of them are printed in the book already mentioned.

It will be noticed that the numbers 1-108 are placed at the left of the diagrams, and those from 109 to 216 inclusive at the right in inverse order. Consequently the sum of those opposite each other is everywhere 217. In each diagram are two pairs of numbers connected by dotted lines and marked  $\odot$ . These in every case are to be interchanged. Starting then at the heavy dot at the top we follow the black line across to 215, down to 212 (substituting 3 for 213) and back to 6; then across on the dotted line to 210 and along the zigzag black line to 8, 208, 207, 11 and 7 (interchanged with 205):

down the dotted line to 204, then to 203, 15, 16, 14 (in place of 200), 199; then across the diagram and upward, observing the same methods, back to 216. This gives us the numbers which constitute our square No. I, written from left to right in successive rows. In like manner the diagrams in column II give us square No. II, and so on to the end. It is worthy of notice that in the fourth column of diagrams the numbers are written in the reverse of their natural order. This is because it was necessary in writing the fourth square to begin with the number 145 (which naturally would be at the bottom of the diagram) in order to give the initial numbers the desired sum of 651.

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#### A NEW METHOD FOR MAKING MAGIC SQUARES OF AN ODD DEGREE.

In an endeavor to discover a general rule whereby all forms of magic squares might be constructed, and thereby to solve the question as to the possible number of squares of the fifth order, a method was devised whereby squares may be made, for whose construction the rules at present known to the writer appear to be inadequate.

A *general rule*, however, seems as yet to be unattainable; nor does the solution of the possible number of squares of an order higher than four seem to be yet in sight, though, because of the discovery, so to speak, of hitherto unknown variants, the goal must, at least, have been brought nearer to realization.

The new method now to be described does not pretend to be other than a partial rule, i. e., a rule by which most, but possibly not *all* kinds of magic squares may be made. It is based on De La Hire's method, i. e., on the implied theory that a normal magic square is made up of two primary squares, the one superimposed on the other and the numbers in similarly placed cells added together. This theory is governed by the fact that a given series of numbers may be produced by the consecutive addition of the terms of two or more diverse series of numbers. For example, the series of natural numbers from one to sixteen may be regarded (*a*) as a single series, as stated, or (*b*) as the result of the addition, successively, of all the terms of a series of eight terms to those of another series of two terms. For example, if series No. 1 is composed of 0-1-2-3-4-5-6

and 7 and series No. 2 is composed of 1 and 9, all the numbers from 1 to 16 may be thus produced. Or (c) a series of four numbers, added successively to all the terms of another series of four numbers, will likewise produce the same result, as for example 0-1-2 and 3, and 1-5-9 and 13.

Without undertaking to trace out the steps leading up to the rule to be described, we will at once state the method in connection with a  $5 \times 5$  square. First, two primary squares must be made, which will hereafter be respectively referred to as the A and B primary squares. If the proposed magic square is to be *regular*, that is, if its complementary couplets are to be arranged geometrically equidistant from the center, the central cell of each square must naturally be occupied by the central number of the series of which the square is composed. The two series in this case may be 1-2-3-4-5 and 0-5-10-15-20. The central number of the first series being 3 and of the second series 10, these two numbers must occupy the central cells of their respective squares.

	3			
3				
		3		
				3
			3	

Fig. 1.

			10	
				10
		10		
10				
	10			

Fig. 2.

				3
	3			
		3		
			3	
3				

Fig. 3.

In each of these squares, each of the terms of its series must be represented five times, or as many times as the series has terms. Having placed 3 and 10 in their respective central cells, four other cells in each square must be similarly filled. To locate these cells, any geometrical design may be selected which is *balanced* about the central cell. Having done this in primary square A the *reverse* of the same design must be taken for primary square B, two examples being shown in Figs. 1 and 2 and Figs. 3 and 4.

Having selected a design, the next step will be to fill the *central* row, which may be done by writing in any of the four empty cells in this row, any of the four remaining terms of the series. The opposite cell to the one so filled, must then be filled with the complementary number of the one last entered. Next, in either of the two remaining empty cells, write either of the remaining two terms

of the series, and, in the last empty cell the then remaining number, which will complete the central row as shown in Fig. 5. All the other rows in the square must then be filled, using the same *order*

10				
			10	
		10		
	10			
				10

Fig. 4.

	3			
3				
4	1	3	5	2
				3
			3	

Fig. 5.

1	3	5	2	4
3	5	2	4	1
4	1	3	5	2
5	2	4	1	3
2	4	1	3	5

Fig. 6.

of numbers as in this *basic* row, and the square will be completed as shown in Fig. 6. The second square can then be made up with the numbers of its series in exactly the same way, as shown in Fig. 7.

5	15	0	10	20
20	5	15	0	10
15	0	10	20	5
10	20	5	15	0
0	10	20	5	15

Fig. 7.

6	18	5	12	24
23	10	17	4	11
19	1	13	25	7
15	22	9	16	3
2	14	21	8	20

Fig. 8.

				3
	3			
		3		
			3	
3				

Fig. 9.

Adding together the terms of Figs. 6 and 7, will give the regular 5×5 magic square shown in Fig. 8, which can not be made by any previously published rule known to the writer. Another example

4	5	1	2	3
2	3	4	5	1
1	2	3	4	5
5	1	2	3	4
3	4	5	1	2

Fig. 10.

10	5	0	20	15
0	20	15	10	5
20	15	10	5	0
15	10	5	0	20
5	0	20	15	10

Fig. 11.

14	10	1	22	18
2	23	19	15	6
21	17	13	9	5
20	11	7	3	24
8	4	25	16	12

Fig. 12.

may be given to impress the method on the student's mind, Fig. 9 showing the plan, Figs. 10 and 11 the A and B primary squares, and Fig. 12 the resulting magic square. Any odd square can be readily

made by this method, a  $7 \times 7$  being shown. Fig. 13 shows the plan, Figs. 14 and 15 being the primary squares and 16 the complete example. Returning to the  $5 \times 5$  square, it will be seen that in filling out the central row of the A primary square Fig. 5, for the first of the four empty cells, there is a choice of 16, and next a choice

Fig. 13.

Fig. 14.

of four. Also for the B primary square there are the same choices. Hence we have

$$(16 \times 4)^2 = 4096 \text{ choices.}$$

In addition to this, by *reversing the patterns* in the two primary squares, the above number can be doubled.

Fig. 15.

Fig. 16.

It is therefore evident that with any chosen geometrical plan, 8192 variants of regular  $5 \times 5$  squares can be produced, and as at least five distinct plans can be made, 40,960 different  $5 \times 5$  regular squares can thus be formed. This however is not the limit, for the writer believes it to be a law that all "*figures of equilibrium*" will

produce magic squares as well as *geometrically* balanced diagrams or plans.

Referring to Fig. 17, if the circles represent equal weights connected as by the dotted lines, the system would balance at the center of the square. This therefore is a "figure of equilibrium" and it may be used as a basis for magic squares, as follows: Fill the marked cells with a number, as for example 1 as in Fig. 18; then

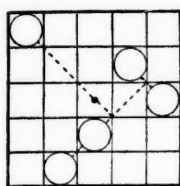


Fig. 17.

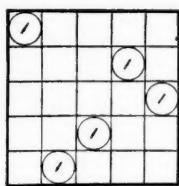


Fig. 18.

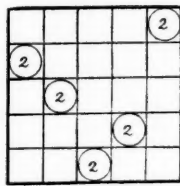


Fig. 19.

with the other numbers of the series, (excepting only the central number) make three other similar "figures of equilibrium" as shown separately in Figs. 19, 20 and 21, and collectively in Fig. 22. The four cells remaining empty will be geometrically balanced, and must be filled with the middle terms of the series (in this instance 3) thus completing the A primary square as shown in Fig. 23. Fill the B primary square with the series 0-5-10-15-20 in the same manner as

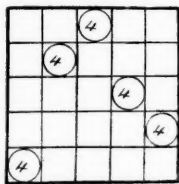


Fig. 20.

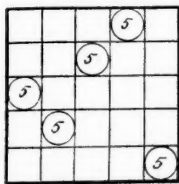


Fig. 21.

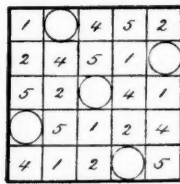


Fig. 22.

above described and as shown in Fig. 24. The combination of Figs. 23 and 24 produces the regular magic square given in Fig. 25.

There are at least five different "figures of equilibrium" that can be drawn in a  $5 \times 5$  square, and these can be readily shown to give as many variants as the geometrical class, which as before noted yield 40,960 different squares. This number may therefore now be doubled raising the total to 81,920 regular  $5 \times 5$  magic

squares, that are capable of being produced by the rules thus far considered.

The student must not however imagine that the possibilities of this method are now exhausted, for a further study of the subject

1	3	4	5	2
2	4	5	1	3
5	2	3	4	1
3	5	1	2	4
4	1	2	3	5

Fig. 23.

5	0	15	10	20
10	20	0	15	5
20	15	10	5	0
15	5	20	0	10
0	10	5	20	15

Fig. 24.

6	3	19	15	22
12	24	5	16	8
25	17	13	9	1
18	10	21	2	14
4	11	7	23	20

Fig. 25.

will show that a geometrical pattern or design may often be used not only with its own reverse as shown, but also with another *entirely*

0	5	15	20	10
5	15	20	10	0
15	20	10	0	5
20	10	0	5	15
10	0	5	15	20

Fig. 26.

3	1	2	4	5
5	3	1	2	4
4	5	3	1	2
2	4	5	3	1
1	2	4	5	3

Fig. 27.

2	4	1	3	5
3	5	2	4	1
4	1	3	5	2
5	2	4	1	3
1	3	5	2	4

Fig. 28.

*different design*, thus rendering our search for the universal rule still more difficult.

3	6	17	24	15
10	18	21	12	4
19	25	13	1	7
22	14	5	8	16
11	2	9	20	23

Fig. 29.

2	9	16	23	15
8	20	22	14	1
19	21	13	5	7
25	12	4	6	18
11	3	10	17	24

Fig. 30.

For example the pattern shown in Fig. 26 may be combined in turn with its reverse shown in Fig. 27 and also with Fig. 28, making the two regular magic squares shown in Figs 29 and 30.



In consideration of this as yet unexplored territory, therefore, the rules herein briefly outlined can only be considered as partial, and fall short of the "universal" rule for which the writer has been seeking. Their comprehensiveness however is evidenced by the fact that *any square* made by any other rule heretofore known to the

4	2	5	3	1
3	1	4	2	5
2	5	3	1	4
1	4	2	5	3
5	3	1	4	2

Fig. 31.

2	3	4	5	1
4	5	1	2	3
1	2	3	4	5
3	4	5	1	2
5	1	2	3	4

Fig. 32.

3	1	4	2	5
5	3	1	4	2
2	5	3	1	4
4	2	5	3	1
1	4	2	5	3

Fig. 33.

writer, may be made by these rules, and also a great variety of other squares, which may only be made with great difficulty, if at all, by the older methods.

To show the application of these rules to the older methods, a few squares given by Mr. Andrews in his recent book on *Magic Squares and Cubes* may be analyzed.

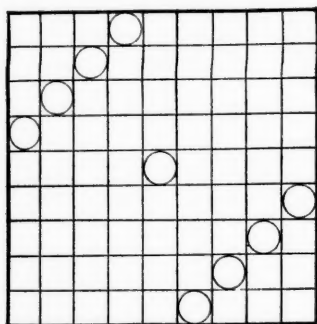


Fig. 34.

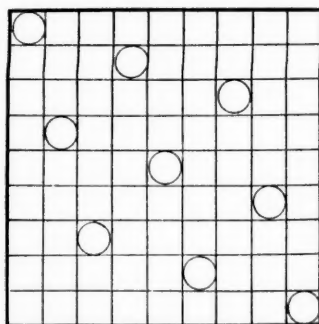


Fig. 35.

Figs. 31, 32 and 33 show the plans of  $5 \times 5$  squares given in Figs. 22, 23 and 41 in the above mentioned book.

Their comprehensiveness is still further emphasized in squares of larger size, as for example in the  $7 \times 7$  square shown in Fig. 16, which can not be constructed by any of the older methods known

to the writer. Two final examples are shown in Figs. 34 and 35 which give plans of two  $9 \times 9$  squares which if worked out will be found to be unique and beyond the power of any other rule to produce. In conclusion an original and curious  $8 \times 8$  square is submitted in Fig. 39. This square is both "regular" (in the sense of being centrally balanced) and "continuous" or "Nasik," inasmuch as all constructive diagonals give the correct summation, a combination of two qualities which is believed to be new in squares of  $8 \times 8$ .

The theory upon which the writer proceeded in the construction of this square was to consider it as a compound square composed of four  $4 \times 4$  squares, the latter being in themselves "continuous" but not "regular." That the latter quality might obtain in the  $8 \times 8$

1	14	7	12	B			
15	4	9	6				
10	5	16	3				
8	11	2	13				
A				C			
D				4	15	6	9
				14	1	12	7
				11	8	13	2
				5	10	3	16

Fig. 36.

1	14	7	12	3	16	5	10
15	4	9	6	13	2	11	8
10	5	16	3	12	7	14	1
8	11	2	13	6	9	4	15
2	13	8	11	4	15	6	9
16	3	10	5	14	1	12	7
9	6	15	4	11	8	13	2
7	12	1	14	5	10	3	16

Fig. 37.

square, each *quarter* of the  $4 \times 4$  square is made the exact counterpart of the similar *quarter* in the diagonally opposite  $4 \times 4$  square, but turned on its axis 180 degrees.

Having in this manner made a "regular" and continuous  $8 \times 8$  square composed of four  $4 \times 4$  squares, each containing the series 1 to 16 inclusive, another  $8 \times 8$  square, made with similar properties, with a proper number series and added to the first square term to term will necessarily yield the desired result.

Practically, the work was done as follows: In one quarter of an  $8 \times 8$  square, a "continuous" (but not "regular")  $4 \times 4$  square was inscribed, and in the diagonally opposite quarter another  $4 \times 4$  square was written in the manner heretofore described and now illustrated in Fig. 36. A simple computation will show that in the unfilled parts of Fig. 36, if it is to be "continuous," the contents of the cells

C and D must be 29 and A and B must equal 5. Hence A and B may contain respectively 1 and 4, or else 2 and 3. Choosing 2 and 3 for A and B, and 14 and 15 for D and C, they were located as marked by circles in Fig. 37, the "regular" or centrally balanced idea being thus preserved.

The other two quarters of the  $8 \times 8$  square were then completed in the usual way of making nasik  $4 \times 4$  squares, thus producing the A primary square shown in Fig. 37, which, in accordance with our theory must be both "regular" and "continuous" which inspection confirms.

As only the numbers in the series 1 to 16 inclusive appear in this square, it is evident that they must be combined term by term, with another square made with the series 0-16-32-48 in order that the final square may contain the series 1 to 64 inclusive. This is accom-

0	48	32	16
48	0	16	32
16	32	48	0
32	16	0	48

Fig. 38.

1	14	55	60	35	48	21	26
15	4	57	54	45	34	27	24
58	53	16	3	28	23	46	33
56	59	2	13	22	25	36	47
18	29	40	43	52	63	6	9
32	19	42	37	62	49	12	7
41	38	31	20	11	8	61	50
39	44	17	30	5	10	51	64

Fig. 39.

plished in Fig. 38, which shows a  $4 \times 4$  square both "regular" and "continuous," composed of the numbers in the above mentioned series.

At this point, two courses of operation seemed to be open, the first being to expand Fig. 38 into an  $8 \times 8$  square, as in the case of the A primary square, Fig. 37, and the second being to consider Fig. 37 as a  $4 \times 4$  square, built up of sixteen subsquares of  $2 \times 2$  regarded as units.

The latter course was chosen as the easier one, and each individual term in Fig. 38 was added to each of the four numbers in the corresponding quadruple cells of Fig. 37, thus giving four terms in the complete square as shown in Fig. 39. For example 0 being the term in the upper left-hand cell of Fig. 38, this term was added to 1-14-15-4 in the first quadruple cell of Fig. 37, leaving these numbers

unchanged in their value, so they were simply transferred to the complete magic square Fig. 39. The second quadruple cell in Fig. 37 contains the numbers 7-12-9-6, and as the second cell in Fig. 38 contains the number 48, this number was added to each of the last mentioned four terms, converting them respectively into 55-60-57 and 54, which numbers were inscribed into the corresponding cells of Fig. 39, and so on throughout.

Attention may here be called to the "figure of equilibrium" shown in Fig. 38 by circles and its quadruple reappearance in Fig. 39 which is a complete "regular" and "continuous"  $8 \times 8$  magic square, having many unique summations.

The writer wishes to express his gratitude to his friend, and fellow student, Mr. W. S. Andrews, of Schenectady, New York, for having executed the diagrams illustrating this article and other incidental assistance. It is exceedingly doubtful whether this contribution to the literature of magic squares would ever have seen the light of day without his generous aid.

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FRIERSON, LA.

#### OVERLAPPING MAGIC SQUARES.\*

A peculiar species of Compound Squares may be called overlapping magic squares. In these the division is not made as usual by some factor of the root into four, nine, sixteen or more subsquares of equal area, but into several subsquares or panels not all of the same size, some lying contiguous, while others overlap. The simplest specimens have two minor squares of equal measure apart in opposite corners, and in the other corners two major squares which overlap at the center, having as common territory a middle square  $2 \times 2$ ,  $3 \times 3$ , or larger, or only a single cell. Such division can be made whether the root of the square is a composite or a prime number, as 4-5-9; 4-6-10; 5-6-11; 6-9-15; 8-12-20 etc. The natural series 1 to  $n^2$  may be entered in such manner that each subsquare shall be magic by itself, and the whole square also magic to a higher or lower degree. For example the 9-square admits of division into two minor squares  $4 \times 4$ , and two major squares  $5 \times 5$  which overlap in the center having one cell in common. For convenience, the process of construction may begin with an orderly arrangement of materials.

\* The diagrams have been drawn by Mr. W. S. Andrews of Schenectady, New York.

The series 1 to 81 is given in Fig. 1, which may be termed a *primitive square*. The nine natural grades of nine terms each, appear in direct order on horizontal lines. It is evident that any natural series 1 to  $n^2$  when thus arranged will exhibit  $n$  distinct grades of  $n$  terms each, the common difference being unity in the horizontal direction,  $n$  vertically,  $n+1$  on direct diagonals, and  $n-1$  on transverse diagonals. This primitive square is therefore something more than a mere assemblage of numbers, for, on dividing it as proposed, there is seen in each section a set of terms which may be handled as regular grades, and with a little manipulation may become magical. The whole square with all its component parts may be tilted over to right or left  $45^\circ$ , so that all grades will be turned into a diagonal direction, and all diagonals will become rectangular rows, and presto,

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81

Fig. 1.

the magic square appears in short order. The principle has been admirably presented and employed in various connections by Mr. W. S. Andrews in his recent treatise on *Magic Squares and Cubes*, and the process is beautifully illustrated on pp. 17 and 113 of that work. It is a well-known fact that the primitive square gives in its middle rows an average and equal summation; it is also a fact not so generally recognized, or so distinctly stated, that *all* the diagonal rows are already correct for a magic square. Thus in this 9-square the direct diagonal, 1, 11, 21, 31 etc. to 81 is a mathematical series,  $4\frac{1}{2}$  normal couplets = 369. Also the parallel partial diagonal 2, 12, 22, 32, etc. to 72, eight terms, and 73 to complete it, = 369. So of all the broken diagonals of that system; so also of all the nine transverse diagonals; each contains  $4\frac{1}{2}$  normal couplets or the value

thereof = 369. The greater includes the less, and these features are prominent in the subsquares. By the expeditious plan indicated above we might obtain in each section some squares of fair magical quality, quite regular and symmetrical, but when paired they would not be equivalent, and it is obvious that the coupled squares must have an equal summation of rows, whatever may be their difference of complexion and constitution. The major squares are like those once famous Siamese twins, Eng and Chang, united by a vinculum, an organic part of each, through which vital currents must flow; the central cell containing the middle term 41, must be their bond of union, while it separates the other pair. The materials being parceled out and ready to hand, antecedents above and consequents below, an equitable allotment may be made of normal couplets to each square. Thus from N. W. section two grades may be taken as they stand horizontally, or vertically, or diagonally or any way symmetrically. The consequents belonging to those, found in S. E. section will furnish two grades more and complete the square. The other eight terms from above and their consequents from below will empty those compartments and supply the twin 4-square with an exact equivalent. Some elaborate and elegant specimens, magic to a high degree may be obtained from the following distribution:

1st grade 1, 3, 11, 13 (all odd), 2, 4, 10, 12 (all even);

2d grade 19, 21, 29, 31 and 20, 22, 28, 30.

Then from N. E. section two grades may be taken for one of the major squares; thus 5, 6, 7, 8, 9 and 23, 24, 25, 26, 27 leaving for the twin square, 14, 15, 16, 17, 18 and 32, 33, 34, 35, 36. To each we join the respective consequents of all those terms forming 4th and 5th grades, and they have an equal assignment. But each requires a middle grade, and the only material remaining is that whole middle grade of the 9-square. Evidently the middle portion, 39, 40, 41, 42, 43 must serve for both, and the 37, 38, and their partners 44, 45 must be left out as undesirable citizens. Each having received its quota may organize by any plan that will produce a magic and bring the middle grade near the corner, and especially the number 41 into a corner cell.

In the 5-square Fig. 2 we may begin anywhere, say the cell below the center and write the 1st grade, 14, 15, 16, 17, 18, by a uniform oblique step moving to the left and downward. From the end of this grade a new departure is found by counting two cells down or three cells up if more convenient, and the 2d grade, 32, 33, 34, 35, 36 goes in by the same step of the 1st grade. All the

grades follow the same rule. The leading terms 14, 32, 39, 46, 64 may be placed in advance, as they go by a uniform step of their own, analogous to that of the grades; then there will be no need of any "break move," but each grade can form on its own leader wherever that may stand, making its proper circuit and returning to its starting point. The steps are so chosen and adjusted that every number finds its appointed cell unoccupied, each series often crossing the path of others but always avoiding collision. The resulting square is magic to a high degree. It has its twelve normal couplets arranged geometrically radiating around that unmatched middle term 41 in the central cell. In all rectangular rows and in all diagonals, entire and broken, the five numbers give by addition the constant  $S=205$ . There are twenty such rows. Other remarkable traits might be mentioned.

50	39	33	16	67
34	17	68	46	40
64	47	41	35	18
42	36	14	65	48
15	66	49	43	32

Fig. 2.

23	45	58	73	6
55	70	5	31	44
13	30	41	52	69
38	51	77	12	27
76	9	24	37	59

Fig. 3.

For the twin square Fig. 3, as the repetition of some terms and omission of others may be thought a blemish, we will try that discarded middle grade, 37, 38, 41, 44, 45. The other grades must be reconstructed by borrowing a few numbers from N. W. section so as to conform to this in their sequence of differences, as Mr. Frierson has ably shown (Andrews, p. 152). Thus the new series in line 5-6-9-12-13, 23-24-27-30-31, 37-38-(41)-44-45 etc. has the differences 1 3 3 1 repeated throughout, and the larger grades will necessarily have the same, and the differences between the grades will be reciprocal, and thus the series of differences will be balanced geometrically on each side of the center, as well as the normal couplets. Therefore we proceed with confidence to construct the 5-square Fig. 3 by the same rule as used in Fig. 2, only applied in contrary directions, counting two cells to right and one upward. When completed it will be the reciprocal of Fig. 2 in pattern, equivalent in summation, having only the term 41 in common and possessing similar magical properties. It remains to be seen how those

disorganized grades in the N. W. Section can be made available for the two minor squares. Fortunately, the fragments allow this distribution:

Regular grades 1, 2, 3, 4,—irregular grades 7, 8, 10, 11  
19, 20, 21, 22 25, 26, 28, 29

These we proceed to enter in the twin squares Figs. 4 and 5. The familiar two-step is the only one available, and the last half of each grade must be reversed, or another appropriate permutation employed in order to secure the best results. Also the 4th grade comes in before the 3d. But these being consequents, may go in naturally, each diagonally opposite its antecedent. The squares thus made are magical to a very high degree. All rectangular and all diagonal rows to the number of sixteen have the constant  $S = 164$ . Each quadrate group of four numbers  $= 164$ . There are nine of these overlapping 2-squares. The corner numbers or two numbers taken on one side together with the two directly opposite  $= 164$ . The

7	29	71	57
72	56	8	28
11	25	75	53
74	54	10	26

Fig. 4.

1	22	78	63
79	62	2	21
4	19	81	60
80	61	3	20

Fig. 5.

corner numbers of any 3-squares  $= 164$ . There are four of these overlapping combinations arising from the peculiar distribution of the eight normal couplets.

These squares may pass through many changes by shifting whole rows from side to side, that is to say that we may choose any cell as starting point. In fact both of them have been thus changed when taking a position in the main square. The major squares shown in Figs. 2 and 3 pass through similar changes in order to bring the number 41 to a corner. With these four subsquares all in place we have the 9-square, shown in Fig. 6, containing the whole series 1 to 81. The twenty continuous rows have the constant  $S = 164 + 205 = 369$ . Besides the 4-squares in N. W. and S. E. there is a 4-square in each of the other corners overlapping the 5-square, not wholly magic but having eight normal couplets placed geometrically opposite, so that taken by fours symmetrically they  $= 164$ . The four corner numbers  $31 + 36 + 22 + 75 = 164$ .



This combination may be taken as typical of the odd squares which have a pair of subsquares overlapping by a single cell. Whatever peculiarities each individual may exhibit they must all conform to the requirement of equal summation in coupled subsquares; and for the distribution of values the plan of taking as a unit of measure the normal couplet of the general series is so efficacious and of so universal application that no other plan need be suggested. These principles apply also to the even squares which have no central cell but a block of four cells at the intersection of the axes. For example, the 14-square, Fig. 7, has two minor subsquares  $6 \times 6$ , and two major squares  $8 \times 8$ , with a middle square  $2 \times 2$ . This indicates a convenient subdivision of the whole area into 2-squares. Thus in N. W. Section we have sixteen blocks; it is a quasi-4-square, and

75	53	11	25	14	65	48	42	36
10	26	74	54	49	43	32	15	66
71	57	7	29	33	16	67	50	39
8	28	72	56	68	46	40	34	17
52	69	13	30	41	35	18	64	47
12	27	38	51	77	80	20	3	61
37	58	76	9	24	4	60	81	19
73	6	23	45	58	79	21	2	62
31	44	55	70	5	1	63	78	22

Fig. 6.

the compartments may be numbered from 1 to 16 following some approved pattern of the magic square, taking such point of departure as will bring 16 to the central block. This is called 1 for the S. E. section in which 2, 3 etc. to 16 are located as before. Now as these single numbers give a constant sum in every line, so will any mathematical series that may replace them in the same order as 1st, 2d, 3d terms etc. Thus in 1 the numbers 1, 2, 3, 4, in 2; 5, 6, 7, 8, and so on by current groups, will give correct results. In this case the numbers 1 to 18, and 19 to 36 with their consequents should be reserved for the twin minor squares. So that here in the N. W. section we begin with 37, 38, in 1 instead of 1, 2, leaving the 3, 4 spaces to be occupied by the consequents 159, 160. Then in 2 we continue 39, 40 (instead of 5, 6) and so on following the path of the

primary series, putting two terms into each 2-square, and arriving with 67, 68 at the middle square. Then the coupled terms go on 69, 70 = 71, 72 etc. by some magic step across the S. E. section reaching the new No. 16 with the terms 97, 98. This exhausts the antecedents. Each 2-square is half full. We may follow a reversed track putting in the consequents 99, 100 etc. returning to the starting point with 159, 160. It is evident that all the 2-squares are equivalent, and that each double row of four of them = 1576, but it does not follow that each single row will = 788. In fact they

47	149	65	131	56	142	44	154	7	18	133	4	185	184
48	150	66	132	55	141	43	153	186	6	187	134	1	17
57	139	39	157	50	148	62	136	9	15	183	8	181	195
58	140	40	158	49	147	61	135	188	16	13	190	182	2
145	51	133	63	138	60	160	38	12	196	10	3	191	179
146	52	134	64	137	59	159	37	189	180	5	192	11	14
143	53	155	41	152	46	130	68	108	90	103	93	115	81
144	54	156	42	151	45	129	67	107	89	104	94	116	82
25	36	175	22	167	166	99	37	121	75	126	72	114	84
168	24	169	176	19	35	100	38	122	76	125	71	113	83
27	33	165	26	163	177	73	123	85	111	96	102	78	120
170	34	31	172	164	20	74	124	86	112	95	101	77	119
30	178	28	31	173	161	91	105	79	117	70	128	88	110
171	162	23	174	29	32	92	106	80	118	69	127	87	109

Fig. 7.

do so, but that is due to the position of each block as direct or reversed or inverted according to a chart or theorem employed in work of this kind. The sixteen rectangular rows, the two entire diagonals and those which pass through the centers of the  $2 \times 2$  blocks sum up correctly. There are also many bent diagonals and zigzag rows of eight numbers that = 788. Each quarter of the square = 1576 and any overlapping 4-square made by four of the blocks gives the same total. The minor squares are *inlaid*. Thus in the N. E. square if the twenty numbers around the central block be dropped out and the three at each angle be brought together around

the block we shall have a 4-square magical to a high degree. In fact this is only reversing the process of construction.

Fig. 8 is a 15-square which develops the overlapping principle to an unusual extent. There are two minor squares  $6 \times 6$ , and two major squares  $9 \times 9$  with a middle square  $3 \times 3$  in common. The whole area might have been cut up into 3-squares. The present division was an experiment that turned out remarkably well. The general series, 1 to 225 is thus apportioned. For N. W. 6-square the numbers 1 to 18 and 208 to 225; for S. E. 19 to 36 and 190 to

225	216	3	222	5	7	73	143	75	141	77	139	79	152	138
10	1	223	4	221	219	153	83	151	85	149	87	147	88	74
6	220	11	18	212	211	89	129	91	127	93	136	126	81	145
218	8	213	210	12	17	137	97	135	99	133	100	90	82	144
2	224	14	15	215	208	101	119	103	124	118	95	141	150	76
217	9	214	209	13	16	125	107	123	108	102	96	130	84	142
77	149	71	155	69	157	112	117	110	105	121	134	92	148	78
52	174	64	162	70	156	111	113	115	106	120	98	128	86	140
181	45	180	46	186	40	116	109	114	122	104	132	94	146	80
53	173	66	160	168	154	37	167	39	29	36	194	193	24	202
178	48	163	63	72	58	189	59	187	195	192	30	35	20	206
55	171	169	158	38	161	44	159	62	32	33	197	190	200	26
176	50	68	57	188	65	182	67	164	196	191	31	34	199	27
184	165	41	172	43	170	47	146	49	21	204	23	25	207	198
61	42	185	54	183	56	179	80	177	205	22	203	201	28	19

Fig. 8.

207; that is just eighteen normal couplets to each. For S. W. 9-square the numbers 37 to 72 and 154 to 189; for N. E. 73 to 108 and 118 to 153; for the middle square, 109 to 117. Figs. 9 and 10 show the method of construction. The nine middle terms are first arranged as a 3-square, and around this are placed by a well-known process (Andrews, p. 47) eight normal couplets 101 + 125 etc. forming a border and making a 5-square. By a similar process this is enlarged to a 7-square, and this again to a 9-square, Fig. 9. Each of these concentric, or bordered, or overlapping squares is magic by itself. The twin square N. E. is made by the same process with

the same 3-square as nucleus. In order to bring this nucleus to the corner of each so that they may coalesce with a bond of union, both of the squares are turned inside out. That is, whole rows are carried from bottom to top and from left to right. Such transposition does not affect the value of any rectangular row, but it does affect the diagonals. In this case the corner numbers, 74, 138 and 152 become grouped around the other corner 88, each of the couplets having the same diagonal position as before. Thus we obtain a 7-square with double border or panel on the North and East, still magic. This 7-square may now be moved down and out a little, from the border so as to give room to place its bottom row above, and its left column to the right, and we have a 5-square with panels of four rows. Again we move a little down and out

74	153	83	151	85	149	87	147	88
145	90	137	97	135	99	133	100	81
144	131	102	125	107	123	108	95	82
76	130	121	112	117	110	103	96	150
142	92	120	111	113	115	106	134	84
78	128	104	116	103	114	122	98	148
140	94	118	101	119	103	124	132	86
80	126	89	129	91	127	93	136	146
138	73	143	75	141	77	139	79	152

Fig. 9.

1	223	4	221	219	10
220	11	18	212	211	6
8	213	210	12	17	215
224	14	15	215	209	2
9	214	209	13	16	217
216	3	222	5	7	225

Fig. 10.

leaving space for the bottom and left rows of the 5-square and thus the 3-square advances to the required position, and the four squares still overlap and retain all of their magical properties. The twin square S. W. passes through analogous transformation. The minor squares were first built up as bordered 4-s as shown in Fig. 10 and then the single border was changed to double panel on two sides, but they might have gone in without change to fill the corners of the main square. As all this work was done by the aid of movable numbered blocks the various operations were more simple and rapid than any verbal description can be. The 15-square (Fig. 8) as a whole has the constant  $S = 1695$  in thirty rectangular rows and two diagonals, and possibly some other rows will give a correct result. If the double border of fifty-two normal couplets be re-

moved the remaining 11-square, 4-7-11 will be found made up of two 4-squares and two overlapping 7-squares with middle 3-square, all magic. Within this is a volunteer 7-square, of which we must not expect too much, but its six middle rows and two diagonals are correct, and the corner  $2 \times 2$  blocks pertaining to the 4-squares although not composed of actual couplets have the value thereof,  $224 + 228$ . However, without those blocks we have two overlapping 5-squares all right. By the way, these 4-squares have a very high degree of magic, like those shown in Fig. 6, with their 2-squares and 3-squares so curiously overlapping. Indeed, this recent study had its origin some years ago from observing these special features of the 4-square at its best state. The same traits were recognized in the 8's and other congeners; also some remarkable results found in the oddly-even squares when filled by current groups, as well as in the quartered squares, led gradually to the general scheme of overlapping squares as here presented. Other investigators may have been working consciously or unconsciously on similar lines, but perhaps not to a great extent. It will be observed that the sections of Fig. 8 have a resemblance to some curious modifications of the concentric square, devised by Mr. Frierson (Andrews, p. 183). This is not merely a chance coincidence, nor an imitation, but doubtless there was a suggestion of possibilities. Without raising any question of originality or priority of invention it may be claimed that here the purpose and the conditions of the combination were quite different, the materials more extensive, and the methods of construction probably not exactly the same.

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#### THE BAGPIPE NOT A HEBREW INSTRUMENT.

In the course of an interesting article on "Music in the Old Testament," written for *The Monist*, April, 1909, Professor Carl Heinrich Cornill, of Breslau, makes the following statement;<sup>1</sup>

"This 'ugab is most probably the same as the bagpipe, which is of course a very primitive and widely spread instrument, familiar to us as the national instrument of the Scotch, and best known in continental Europe as the *pifferari* of Italy."

As a matter of fact, however, it is not possible to say what manner of musical instrument is referred to in the Old Testament

<sup>1</sup> C. H. Cornill, *loc. cit.*, p. 251.

under the name 'ūgāb. The word occurs only four times.<sup>2</sup> Except in so far as it is defined as the name of a musical instrument, no consistent explanation is given by the mediæval commentators. Abraham di Porta Leone (1612), in the *Shiltē-haggibbōrim*, goes so far as to identify it with the *viola da gamba* of his own day, an identification which cannot, of course, be accepted, for the reason that the principle of bowed instruments was unknown to the Hebrews. To go back to an earlier source, it appears that nothing definite can be derived from the evidence of the Greek and Latin translations of the Bible,—the word being thus variously rendered:

Gen. iv. 21,	LXX	κιθάρα	Vulg. <i>organum</i> . <sup>3</sup>
Job xxi. 12	"	ψαλμός	" <i>organum</i> .
Job xxx. 31	"	ψαλμός	" <i>organum</i> .
Ps. cl. 4,	"	ὄργανον	" <i>organum</i> .

There is no evidence whatever that it was a bagpipe.

An explanation to this effect has, however, found its way into encyclopedias and commentaries. Its source has lately been traced<sup>4</sup> to a misunderstanding, complicated further by inaccurate references, of a note in Winer's *Realwörterbuch*,<sup>5</sup> that a Hebrew version of the Aramaic parts of the book of Daniel has in iii. 5 'ūgāb for *sūmṣōnyāh*.<sup>6</sup> The date of this version which is found in a manuscript of 1327, is uncertain; it contains, beside other errors, the obvious mis-translation, *sabbeka* = *hālil*,<sup>7</sup> so that it is of doubtful value, to say the least.<sup>8</sup>

Of the meaning of *sūmṣōnyāh*, in Daniel iii. 5, there is no doubt. It is the name of the bagpipe, and indeed the only name by which

<sup>2</sup> Gen. iv. 21; Job. xxi. 12; xxx. 31; Ps. cl. 4.

<sup>3</sup> The English A. V., following St. Jerome, has "organ," R. V. reads "pipe," following the Aramaic Targums, which render 'ūgāb always by 'ābūbā, "a pipe."

<sup>4</sup> G. F. Moore, in *Journal of Biblical Literature*, xxiv, part ii, 1905, pp. 169-171. The author has rendered a valuable service to the world of scholarship in tracing this misinterpretation to its source.

<sup>5</sup> G. B. Winer, *Biblisches Realwörterbuch*, Leipsic, 1849.

<sup>6</sup> Winer, *loc. cit.*, vol. ii, p. 123, s. v. "Musikalische Instrumente": (a) זָבִיבָה Gen. iv. 21; Hiob xxi. 12.a, nach den jüdischen Interpreten, Chald. und Hieron. die Sackpfeife, Dudelsack, und (b) זָבִיבָה דָּנִיֵּל chald. Dan. iii. 5; x. 15, συμφωνία. Polyb. bei Athen. x. 439, wohl eben dasselbe, wie denn die hebr. Uebersetzung dafür זָבִיבָה hat.

<sup>7</sup> *Sabbeka*, σαμβύκη, a stringed instrument; *hālil*, a flute.

<sup>8</sup> The author has wisely excluded the four instruments mentioned in Daniel iii. 5, *kitharos*, *sabbeka*, *psantērīn*, and *sūmṣōnyāh*, from his discussion of ancient Hebrew music.

it is known in the Old Testament. The name is a loanword from the Greeks, who knew the bagpipe as *συμφωνία*,<sup>9</sup> and passed the word in this sense on to the Romans, by whom it has been transmitted to the Romance tongues. To-day *zampogna*, the Italian derivative, is the common word for bagpipe among the peasants of Italy,—the *pifferari*, who throng at Christmas time to the cities and play on their pipes (*pifferi*) and bagpipes (*zampogne*) before the street shrines of the Virgin. In Spain, Provence, Roumania, Greece and Hungary, the bagpipe is still called by names derived from *symphonia*—the Greek word has come back into the language in the form *τσαμπούρνα*.<sup>10</sup>

It is true that, with the exception of the Pan's pipe, found in the New World as well as the Old, scarcely any instrument has come into general usage over so wide an extent of territory as the bagpipe. The ancient Greeks knew it,<sup>11</sup> the emperor Nero counted bagpiping among his accomplishments.<sup>12</sup> There remains, however, no evidence that the Hebrews knew it previous to the time of Antiochus Epiphanes.

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### CREDULITY, INCREDULITY, AND IMMORTALITY.

How much may be legitimately asserted as proved with regard to the relations of consciousness and matter? To simplify the question, let us, for the sake of argument, ignore all the claims of psychical research on behalf of the spiritualist hypothesis. Let us assume that we have absolutely no conclusive scientific evidence of the existence of consciousness apart from matter. Let us assume that, in every recorded instance, consciousness has invariably been found in association with matter. What then is our logical position? Is it proved that it is impossible for consciousness to exist apart from matter? Most emphatically not!

And yet, a discussion on Immortality\* reveals the remarkable fact that three eminent persons, Professor Ernst Haeckel, famous

<sup>9</sup> Polybius XXVI, 1; XXX, 26. Cf. LXX, Dan. iii. 5; Luke xv. 25.

<sup>10</sup> See my article, Daniel iii. 5,—*sūmpōnyāh*,—in *Journal of Biblical Literature*, XXVII, part II, 1908, pp. 111-121.

<sup>11</sup> Aristophanes, *Acharnians*, 862-66.

<sup>12</sup> Suetonius, *Nero*, 54. Cf. Dio Chrysostom, *Orat.* LXXI, p. 381, Reiske.

\* See *Open Court*, Vol. XIX, p. 363.

throughout the whole civilized world, Dr. Carus, the editor of a philosophic magazine and well known throughout the whole philosophic world, and Mr. Thaddeus B. Wakeman, who is, I think, a man of distinction among a certain class of American thinkers—have all three publicly and irrevocably committed themselves to the contrary proposition.

What is the explanation of this remarkable phenomenon? Incredulity! And what is incredulity but another form of credulity—equally damnable, and, in persons in such positions, equally disgraceful. Such language, perhaps, may appear to need some apology. I can only say that the occasion deserves it.

Credulity is an unreasonable readiness to believe that something *is*—to believe a positive proposition. Incredulity is an unreasonable tendency to believe that something *is not*—to believe a negative proposition—in popular language, to disbelieve. Both are equally far from the golden mean—calm, cold, clear, unprejudiced, rationalism. The credulous man is too ready to multiply causes—to call in new causes to explain phenomena that can be satisfactorily accounted for by those already admitted. The incredulous man, alarmed at the results of credulity, flies to the other extreme, and tries to get too much out of the most obvious and generally admitted causes. He flatly refuses to admit even the possibility of any but a certain limited few—those most in evidence. He exercises all his ingenuity to see how much in the way of results he can pile on to these. And in his craze for simplification, the final goal he has set himself, is to eliminate all but one—selected as his fancy may dictate.<sup>1</sup> This intellectual monstrosity, Dr. Carus has for ever stigmatized as “Henism.” His abode we might perhaps rightly call “Gehenna.” And it is with great pleasure that I testify that Dr. Carus has proved himself too good for such company. But he is too much in sympathy with Gehenna for all that.

One more instance, and not *quite* such a glaring one is provided in Mr. Abbott’s “Strange Case,” whose admitted strangeness makes it of value beyond comparison with all the other amusing tales with which he has been entertaining us—until that strangeness has been explained away.

The moral honesty with which Mr. Abbott has endeavored to be intellectually honest in his account is as evident as anything can be. But yet he has not succeeded. And still less has Dr. Carus in

<sup>1</sup> Whence we have the Idealism of Prof. Ward, the “Energetics” of Professor Ostwald, and the materialism of others.



his comments. Mr. Abbott's classification of the phenomena that he witnessed under the heads of (1) explicable and (2) unexplained is painstakingly fair and impartial. Yet he exhibits the same irrational prejudice in favor of what he is pleased to call "rational explanation," the same question—begging assumption that the spiritual hypothesis is necessarily the irrational explanation, as Dr. Carus. He quotes with approval Dr. Carus's saying that "when one stands before something that he cannot explain, he should not conclude that it is inexplicable, and attribute it to supernatural causes." The very use of the word "supernatural" here convicts them both of prejudice. All causes that fall outside *their* conception of the world are dubbed supernatural. If there are any such things as spirits, then they must be inherent parts of this universe, and are no more supernatural than are tables and chairs. And to say that to attribute phenomena to such causes is the same as to pronounce them inexplicable amounts to a tacit and utterly unwarranted assumption that such causes cannot possibly have any real existence. An irrational *a priori* conviction of the impossibility of the existence of certain causes is of course proof against any amount of evidence in favor of their existence. And if we go for ever refusing to consider the possibility of the existence of any but known causes, no matter how often we may come across phenomena which are not, as a matter of fact, satisfactorily accounted for by those causes—why then all investigation becomes a mere farce. And a judge who professes to sit in an open court while he has all the time a closed mind is guilty of the very worst kind of intellectual dishonesty, namely dishonesty that masquerades as honesty. Of course the dishonesty is unconscious—just as Dr. Carus (*vide* last para. of his comments) seems to imply that Mrs. Blake's was. But that only makes the moral debacle the more awful.

If astronomical investigations had always been conducted on Dr. Carus's principles, mankind would to this day be ignorant of the actual existence of the planets Neptune and Uranus, and of the fact of the velocity of light. When we stand in the presence of something that we cannot explain, it is every bit as immoral to persist that it must be explicable by known causes, as to jump to the conclusion that hitherto unknown causes must be called in. Of course it is always open to us, as Dr. Carus says, to "comfort ourselves" by the reflection that the phenomena could be explained on known causes, *if*—something or other. Note the unblushing irrational prejudice that stands confessed in those two words "comfort our-

selves." Our intellectual comfort is to be our guide. No doubts as to our own fallibility shall distress us, no disquieting thoughts that after all there may be causes not dreamt of in our philosophy, —facts that won't fit into our cut and dried scheme. But we cannot go on laying ghosts that way for ever. They will not put up with it. Unfortunately there always is that "if" in these apparently inexplicable cases. And as these cases have been going on multiplying for a good while now, there are not wanting many eminent scientific men who have come to the conclusion that it is time for the spiritual theory to rank as a working hypothesis. In the only notice that Dr. Carus has ever condescended to take of Mr. F. W. H. Myers either in *The Open Court* or *Monist*—a brief reference tacked on the end of some little note or book review in the miscellaneous matter at the end of an *Open Court*, which I have tried unsuccessfully to find again—Dr. Carus admits that Mr. Myers has done more in this direction than anybody else. But he characteristically adds that "even he cannot be said to have proved" the spiritual hypothesis. Dr. Carus could not bring himself to say that Mr. Myers had signally failed in his attempt. And so he "comforts himself" with the reflection that the hypothesis is still not proved. Why should this be a comfort to him any more than the other alternative? The honest way of stating such a case would have been to say that Mr. Myers had produced a great deal of evidence in favor of the hypothesis, and had done much to render it probable. Still this Scotch verdict of "not proven," into which Dr. Carus has betrayed himself in this single brief and passing allusion contrasts not unfavorably with the attitude of dogmatic denials of the possibility of the spiritual hypothesis—the attitude characteristic of Prof. Ernst Haeckel, and certainly endorsed by Dr. Carus and Mr. Wake-man, in the instance above quoted, in *The Open Court* for June 1905. And coupling this "not proven" together with several other slight indications, e. g., his admission of his need of "comfort," I am inclined to suspect in my own mind that Dr. Carus finds his intellectual position not quite as comfortable as he would have us believe. His ghosts are not quite as effectually laid as he would like. He has never scoffed; that is one thing. Therein is some hope of his redemption.

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With regard to the general question of individual immortality, however, I must confess that my own interest has until lately been philosophic, rather than scientific. I have not troubled much to

weigh the direct scientific evidence that modern spiritualism claims to have discovered in these extraordinary phenomena; for the simple reason that it has always seemed to me superfluous to turn to such phenomena for proof of the spiritual hypothesis. The philosophic proof of that hypothesis has always appeared to me so overwhelming as to reduce to comparative insignificance the importance of scientifically demonstrable instances of the truth. And science for science's sake, independently of its argument that we have no direct scientific proof of the existence of an individual and therefore immortal soul, it has nevertheless always seemed to me that the truth of this existence is an inevitable inference from the common facts of daily life.

In the philosophic treatment of this subject, however, as in the scientific, the same deep prejudice is shown by the whole anti-spiritualist school. The philosophic argument is one that I have never yet seen fairly stated. The old-fashioned orthodox spiritualist school have had their apriorism well rubbed into them by the anti-spiritualists; but these latter, with Dr. Carus among them, are all deeply tarred with the same brush. It is an extraordinary thing that there is a large class of thinkers who are ready to believe anything, rather than that they have individual immortal souls; and they will commit the most flagrant mistakes in common logical calculations, rather than admit such a conclusion. In the *Monist* for January 1908, Dr. Carus was kind enough to publish one of my "overwhelming" philosophic arguments, in which I endeavored to show how the whole modern scientific school have blundered over the subject of human will in its relation to the conservation of energy, because of their obstinate refusal to admit the spiritual hypothesis. No feats of dialectic or argumentative contortions can ever make it possible that animal movements that are partly determined by consciousness can at the same time be entirely determined by mechanical antecedents. The anti-spiritualists, however, defy all logic in their effort to bolster up materialism. And each has a patent of his own for wriggling out of this awkward position. Dr. Carus, however, after describing his patent, unblushingly admits that the real ground of his objection to a theory of spiritual causation is his own prejudice in favor of what he calls "a truly consistent monistic view"—that is, an anti-spiritualistic one. The argument by which he seeks to uphold the old-fashioned materialist version of the conservation of energy, is one which is part and parcel of my own spiritualist version of that doctrine. Meanwhile, by way

of conclusion, I would like here to present him with another philosophical conclusion, from which, I must confess, I myself personally have never yet been able to discover any possibility of escape.

All true philosophy must, to my mind, be based upon one axiom and one only—namely that the universe has a meaning. Despite all its apparent inconsistencies and contradictions, we must believe, if we are not to be put to intellectual confusion, that it is really one harmonious whole. And our business as philosophers is simply to discover the system on which it is built—the key that shall explain it all. To assume that there is a system, and then to search for it.

Dr. Carus himself admits that a place must be found in our world-conception for the immortality of the soul. And he claims to have fitted in that doctrine to his philosophy—in short, to have wedded together spiritualism (or rather soul-ism) and materialism.<sup>2</sup> But he has not. His immortality is a spurious article. He has fitted it to his materialistic universe only by depriving it of all immortality except in name.

If his philosophy is true, then the fact remains, as he himself admits, that, one day, all life, all mind and soul, all consciousness, all thought, all noble aspirations toward the high, all struggles against lower ideals, all goodness, all sin, all sorrow and all joy,—all that makes man man, and that gives life any purpose or value—will be as completely wiped out and extinct in this world as if they had never existed. It may sound an unphilosophic remark; but I can only say that that, to my mind, is rank twaddle. What does it matter what any of us do or think! It will all be the same a million years hence. Why not bore a big hole to the center of the earth and put in a billion tons of dynamite, and have done with it all for ever, *now*. It might be argued that if we can make sure of a million years of soul-survival, that ought to be enough to content us. But what is a million years, or what is time at all?! In the affairs of the universe, a million years is much the same thing as five minutes. What possible purpose could there be in for ever bringing worlds into existence like that, one after the other,—just to wipe them out again? I live for you, and you for me, and you and I live for posterity, and they for some other posterity—and so on. And one day there won't be any posterity. What then?

<sup>2</sup> By materialism I mean simply anti-spiritualism, a conception of the universe which denies spirit. I quite understand and sympathize with Dr. Carus's reasons for repudiating the charge of materialism.

What, I ask, is the value of life itself, as life? And you can only reply—NONE! You admit that and you say you are satisfied. Continued individual existence has no attraction for you. Of course not—if you have drugged your soul to make it fit into your little picture of life. No one would want a continuous existence such as that of this present human race chained here to this earth. But do no possibilities beyond that rise in one's mind—no wider life sharing in the life of the universe itself? My soul does not belong to here and now—it belongs to God.

And God! your God! a big machine, *dévoid* of consciousness. You are very much impressed with the "wonderful"-ness of consciousness. If it fills you so with wonder, I should suspect that after all it does not fit quite so comfortably into your little universe—the little shoes you have made for it. You try to account for it. It is a fact—undeniable. It is wonderful. It is the fabric of the soul. It is not a substance, nor a permanent existence, nor an entity. It originates and disappears (creation out of nothing—no—beg pardon—consciousness *is* nothing). The fact remains, however, that this queer thing is the greatest thing in the world. And yet, (1) one day it will be gone for ever! and (2) it is not in God! I can only say—If I have nothing greater than myself to loop up to and depend on, if the material soul-less world is my father and my God, then woe is me, and woe is the world! I am left face to face with a fathomless pessimism.

I know that Dr. Carus would say that even the material world is not absolutely soul-less—that all matter has a subjectivity of a sort. And that soul has in some mysterious way grown out of this subjectivity of matter—that the substance of the world is not, in any department of it, absolutely inanimate. But be that as it may, it makes no difference to the burden of my complaint. Relatively to us the material world is inanimate and soul-less. In the spiritual aspect of it, it is beneath us. The first beginnings of soul are necessarily inferior to its climax. And it is an uncomfortable position for an aspiring soul to find itself in—at the top, with no infinitely greater beyond to aspire to. That has ever been the complaint of the spiritualist against evolution. Evolution is a truth; but it is not the whole truth. It requires what spiritualists call "involution" to complete it—that is, the descent of the infinite, the perfect, into the finite—the incarnation of God. The finite soul could never have evolved unless the perfect soul had existed in the infinite. Soul is the highest thing in us. And we search in God for all that is

highest in ourselves—only, in God, it must be on a still higher scale—not on a lower. Of course God's consciousness cannot be ours. It is ours with the condition of infinity added to it—that is, it is unconditioned, infinite, transcendental. What it actually is like, we can hardly describe. Because it has no like. It is unique. We can only say of it that it is something that corresponds on the infinite scale to our consciousness on the finite scale. It is that from which finite consciousness can be evolved. It needs, perhaps, the subtlety of a German to help us out here. Kant tells us that God's consciousness is free from the limitations of space and time; and that therefore it is not thinking. He calls it "primitive intuition."<sup>8</sup> Dr. Carus says that God is super-personal. So do I. But this is my idea of super-personality. I think Dr. Carus ought to come round to it without much difficulty. I should rejoice if he could.

W. E. AYTON WILKINSON.

BURMA, INDIA.

### THE OLD AND THE NEW.

IN REPLY TO MR. W. E. AYTON WILKINSON.

Among our subscribers of long standing, there has scarcely been a more careful and faithful, and (we must add) more critical reader than Mr. W. E. Ayton Wilkinson, of Thanatpin Burma, in distant India. He was critical because he did not agree with our editorial position which he regarded as rank materialism, he himself being a spiritualist, not of the crude and credulous kind that seek comfort in the seances of mediums, but a thinker who endeavored to base his conviction upon a philosophical foundation. We have exchanged many letters, and several articles of his have appeared in *The Monist*, all of them attacking the editorial views as to the nature of the soul, of consciousness, and of immortality. They were all thoughtful and presented arguments worthy of consideration and answer.

Though personally a stranger, his letters have exhibited a warm friendship, and he lived in the hope of converting us to his views. The last contribution from his pen appears in the current number and we regret to add with great sorrow, that while his article was standing in type and before we sent him proofs, we received the unexpected news of his death.

<sup>8</sup>I do not know German myself; and Mahaffy's and Bernard's Kant is the only edition I have.

I may be permitted to add a few personal remarks. Mr. Wilkinson knew me sufficiently to be certain that I would not hesitate to publish his criticism and he said exactly what he meant. He is impatiently severe and it is greatly to be regretted that he cannot see his article in print and feel the satisfaction of having had his say in all its vigor and directness. I must confess that while reading the manuscript I enjoyed his outspoken expressions which are the more noteworthy as they come from a kind heart. He has always manifested an unusual sympathy for me whom he regarded as the most dangerous opponent of his deeply cherished convictions.

We know little of Mr. Wilkinson's personal affairs, except that he was a mechanical engineer and a thoughtful student of psychology. He took a great interest in the labors of the Society for Psychical Research of England, and always regarded it as an unpardonable negligence on our part that we did not devote more space to their proceedings and other publications. Why we have not done so ought to have been obvious to him, who himself lays more stress upon philosophical reasons than upon scattered facts, or, as he calls them, "scientifically demonstrable arguments of the truth."

Mr. Wilkinson is mistaken, however, when he imagines that I have neglected to consider the methods and results of the S. P. R. I have said little about their work because I have no reason to hinder their investigations, or to dampen the zeal of those well intentioned (but in my opinion strangely mistaken) seekers after truth. The fact is that I have not discovered much that is worth mentioning. The results are all of a negative character which, if they prove anything, indicate that their method is futile. Still I wait for further developments and will not hesitate to call attention to anything that would seem of importance to me.

Mr. Wilkinson is further mistaken in thinking that I have not reviewed Mr. Frederic H. Myers's voluminous work on *Human Personality: Its Survival After Bodily Death*. In addition to the comment from which Mr. Wilkinson quotes, it was reviewed in *The Open Court*, May 19, 1903 (Vol. XVII, p. 308 f.). Moreover I have discussed somewhat at length the experiments made by Professors James and Hyslop with Mrs. Piper and can say only that they are typical of a large number of trance phenomena, so called. They prove nothing more than does Mr. Abbott's "Strange Case" which is interesting only because so much has been made of it by Psychical Researchers; but which I consider (and so does Mr. Abbott) as much of a failure as all the work of the S. P. R.



Now when considering Mr. Wilkinson's strictures, I find that aside from some vigorous protests made in strong language, he offers no tenable arguments whatever, and it is characteristic of him that the ultimate basis of his views is not reached by thought but by sentiment. He is a pragmatist. He believes because he has the will to believe. His psychology has its roots in his attitude toward the world as a whole, and his philosophy is not of an intellectual nature. Attitudes can be neither refuted nor proved; they are subjective.

In the present case, far from rejecting Mr. Wilkinson's attitude, I am inclined to recommend it. I had the same attitude and also the same mode of adjusting my philosophy to it in my younger years, and my present attitude is merely the result of broadening and adapting myself to a deeper insight into the nature of things.

Mr. Wilkinson says:

"All true philosophy must, to my mind, be based upon one axiom and one only—namely that the universe has a meaning. Despite all its apparent inconsistencies and contradictions, we must believe, if we are not to be put to intellectual confusion, that it is really one harmonious whole. And our business as philosophers is simply to discover the system on which it is built—the key that shall explain it all. To assume that there is a system, and then to search for it."

I am prepared to go a step further than Mr. Wilkinson. To me it is not an axiom but a demonstrable truth that the universe is "one harmonious whole" and I have always insisted that "the universe has a meaning." The order of the world (which appears most obviously in the so-called laws of nature) constitutes a system. This system can be traced by science, and furnishes the basis of ethics as well as of religion. Without it could exist neither science, art, morality, nor any of our ideals. It is much more than a mere logical proposition, it is an objective norm; it is the condition of all order, all harmony, the possibility of human personality and of all the grand aspirations which adorn it and make man's existence valuable. In a word, it is what religion calls "God."

Now the difficulty which besets Mr. Wilkinson consists exactly in this: he clings to the symbol or allegory under which this ultimate foundation of the dignity of our existence is conceived. Otherwise we agree. With him I would say, "My soul does not belong here or now; it belongs to God."

Our lives are transient. Every action of ours, every joy, every sorrow, every event be it good or bad, sinful or virtuous, passes by,



and though its traces will linger, the time will come when this whole earth will be no more and we shall be as if we never had been. But the value of our lives does not lie in the number of years, nor is it on the other hand impaired by shortness. Our lives are to be measured by quality of life rather than by quantity of time, and Mr. Wilkinson is quite right when he says, "What is a million years? What is time itself in the life of the universe? A million years is much the same thing as five minutes."

What gives worth to our lives is not quantity but quality, and the quality that elevates us is exactly the eternal background of which we are, or ought to be, the incarnation. Buddha calls the divinity after which we all aspire, the Dhamma, and expresses it thus in some stanzas of the Dhammapada:

"If one should live an hundred years,  
Ignorant, discomposed,  
Better to him were life one day  
Intelligent, enrapt.

"If one should live an hundred years,  
Inert and weak of will,  
Better to him were life one day  
Exerting will-power strong.

"If one should live an hundred years,  
Not seeing the highest Doctrine,  
Better to him were life one day  
When seeing the highest Doctrine."

Mr. Wilkinson says in criticism of my views, "What possible purpose could there be in forever bringing worlds into existence one after another, just to wipe them out again? I live for you and you live for me, and you and I live for posterity and they for some other posterity and so on. And one day there won't be any posterity and what then? What, I ask, is the value of life as life, and you can only reply, NONE."

Mr. Wilkinson forgets that the background of all life which he calls the system of the whole and which I fully recognize, is to all practical extent identical with what in monotheistic religions is called God. It is true enough that I live for you and you live for me and we both live for posterity, and that our interests are mutually balanced so that no one lives for himself alone. The center of gravity lies outside of us, and the farther away it lies from any person the better it is. Woe to him who tries to have the center of his existence in his own puny little self. Egotism is not a system

which recommends itself. It will never satisfy our heart's desire and will leave us as empty as a bubble. When its race is run it will burst and leave nothing behind. It is exactly the significance of its interconnections which gives value to life and makes life's purpose endure.

But we must not forget that all the play of human activities with their mutually balanced interests between you and me and others would be mere nonentities were they not understood to be the surface only of that unfathomable ocean of life which is God, the eternal world-order, the norm of All-Being, the standard of right and wrong, the origin and prototype of our highest ideals, and the final goal to which we return. This unfathomable ocean of which we are the mere surface billows is not a nonentity. Though it is not a bodily or material existence, it is the quintessence of our lives and has been felt to be such by mankind since the most primitive beginnings of civilization. Here lies the root of all religions and I recognize the omnipresence of this eternal norm even though I would reject as mere allegories the definitions and symbols in which myths and dogmas express it.

In the sense of this God-conception, we must read the meaning of our own personal existence. Though there is no individual self, such as Mr. Wilkinson hankers after, I do not hesitate to say that man's soul is an actuality and its significance extends as far as its interests, its sympathies, its comprehensions will reach. Our souls are built up of our ideals, our sympathies and our interests, and as they manifest themselves in our labors and aspirations they are not limited to our bodily existence. Our souls extend wherever our influence goes and so they will live

"Or ever the silver cord be loosed,  
Or the golden bowl be broken,  
Or the pitcher be broken at the well,  
Or the wheel broken at the cistern.

"And the dust return to the earth,  
As it was;  
And the spirit return unto God  
Who gave it." \*

Spiritualists, even those who like Mr. Wilkinson are thinkers, are practically materialists. They cling to the symbol and forget its significance. They overrate the part which consciousness plays, and overlook the fact that the main feature of the soul consists in its

\* Eccl. xii. 6.

thinking, not in its feeling, its sentiency, nor in whatever else belongs to the senses. Consciousness is needed for thinking. It is an instrument but not an end. It is the concentration of feeling (of sense activity) upon one point to which our attention for some or any reason is to be directed. The final purpose of it is to throw light upon the path of life so as to enable us to take the right step and advance in the right direction. Consciousness serves as a searchlight which illumines the field of vision, but is as such transient and secondary. Its main purpose is to gain insight and to discover the truth.

Mr. Wilkinson is a typical representative of many serious people who seek the truth, who know by intuition the significance of religious truths, who know especially that the soul is worth more to us than anything in the world. The soul is we ourselves and the Biblical saying remains true, "What doth it profit a man if he gain the whole world and lose his own soul?" Mr. Wilkinson feels that the great religious truths of the dignity of the soul, of immortality, of moral ideals, would slip away from him if he gave up his soul-conception, and he is so accustomed to the one in which he has been educated that my broader view appears to him purely negative, and I do not think it would have been possible for him to see the deeper meaning of my conception of God, soul, and world though it is perhaps much nearer to his own than he could comprehend. I myself, passed through a long period of despair in which I thought that unless God was exactly as I had pictured him in my childhood, there was no God at all; and if immortality was not exactly the immortality which Christian mythology pictures, it would not and could not afford us comfort. But the world is deeper than we have thought. God is greater than dogmatic religion represents Him to be; our souls are still linked with eternity and before us opens a vista of infinitude.

EDITOR.

## BOOK REVIEWS AND NOTES.

ANTI-PRAGMATISME. Examen des droits respectifs de l'aristocratie intellectuelle et de la démocratie sociale, par *Albert Schinz*, professeur à l'université de Bryn Mawr. Paris: Alcan, 1909. Pp. 301. Price 5 fr.

The first part is a refutation of pragmatism. The problem is reduced to a dilemma: Either the pragmatic method (of judging ideas and theories from their results and not from their own rational value, from their "cash value" as James says, and not from their objective value) is the same as the scientific method, in which case there is no need of a new philosophy; or it is not the same and does not agree with the scientific method, in which case it is *not* scientific. Now, as there can be no thought as to the existence of a pragmatic philosophy (one need only watch the formidable literature on the subject) pragmatism is something *not* scientific. What is it? It consists in reducing philosophy in general to ethical philosophy; in subordinating philosophy to moral purposes. Pragmatism means a return to the age of scholasticism: *Philosophia, ancilla theologiae* said the Middle Ages, *Philosophia, ancilla ethicae* says Pragmatism; Philosophy a "servant" in both cases. The fallacy on which Pragmatic method rests is exposed in book I, pp. 26-37. The pragmatic paradox has been expressed several times since scholasticism; by Pascal ("The heart has its reasons which reason knows not of"), by Rousseau who taught his pupil to use always the criterion of the "useful," and asked the pragmatic question, "What is it good for?" by Kant who claims the rights of "practical reason" as being above those of "pure reason"—i. e., always submitting objective truth to moral postulates or requirements.

The second part asks why, if pragmatism is so weak philosophically, does it have so many followers? Pragmatism must be explained as a special product of modern civilization, or modern preoccupations which are more freely developed in America than elsewhere, hence the fact that pragmatism is especially flourishing in America. In our days of democracy, philosophic ideas are no longer discussed among the chosen few, but by everybody, by the masses; the result is that philosophy is no longer free to express truths which might be dangerous for the masses (see pp. 98-104 for this fundamental development). Philosophy must express only useful, moral, pragmatic truth, even though truth itself lie in an opposite direction; truth must be good, useful. Pragmatism is nothing but this adulterated philosophy; philosophy sold to democracy. Two beliefs are necessary in ages like ours: belief in free-will to stimulate energies; and belief in God's moral government of the world, so as to restrain man from the religion of success. Pragmatism will fight any philosophy, any science, any idea that goes against these two fundamental dogmas.

The third part develops the thesis that pragmatism is good and therefore ought to triumph because it is *not* true; for truth is discouraging from the moral point of view because it is *not* amiable. Thus, it is good to keep the masses from objective truth, and tell them to believe in something else. Pragmatism is good; but pragmatists are deceiving us when they say that pragmatism and philosophy or science agree, for they do not. Pragmatists are right when they advocate pragmatism for the masses, but they are wrong when they claim that pragmatism is objective truth. There is only one way of straightening out matters: let us say that there are two truths, one for the masses and one for the scholar. This attitude would be wrong only if we philosophers were responsible for the fact that real truth is sad, and bad; but we are not; and therefore we will show our humanity, in telling people to believe (the following are James's words): "that which is good for them to believe." (A practical application of the system of two truths to literature is found in Appendix B: "Literature and the Moral Code.")

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ALLGEMEINE GESCHICHTE DER PHILOSOPHIE. Von Dr. Paul Deussen. Vol. II, Part 3. Leipzig: F. A. Brockhaus. 1908. Pp. 728. Price M. 18.

We have now before us the third part of the first volume of this great work on the "General History of Philosophy" written with particular reference to religion. The whole of the first volume is devoted entirely to the history of India, and this division treats of the post-Vedic philosophy of the Hindus. It contains also an appendix to the philosophy of the Chinese and Japanese. In this appendix the author discusses China in general, giving a particular chapter each to Confucius and Lao Tze, following with a history of the development of Chinese philosophy and its three religions. He passes rapidly over ancient Japan and Shinto, Buddhism in Japan, and neo-Confucianism. The "Post-Vedic Philosophy" as a whole discusses first the philosophy of the epic period of India, then Buddhism, and finally the various minor philosophical systems of India.

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RÉCRÉATIONS MATHÉMATIQUES, et Problèmes des temps anciens et modernes.

By W. Rouse Ball. Paris: A. Hermann, 1907. 2 vol. Price, 5 fr. each.

It is only one additional tribute to the well-known value of W. Rouse Ball's *Mathematical Recreations* that a second edition of its French translation has appeared. This translation was made from the fourth English edition and has been somewhat enlarged by the translator, J. Fitz-Patrick. The final addition is a note by the publisher, Mr. A. Hermann, on the "Accounts of a person who spends more than his income; a method for establishing a life annuity." In this an attempt is made to show how three common difficulties may be conciliated, that is to say how the income may be increased while care must be taken not to deprive the heirs in case of premature death, and at the same time to safeguard a sufficient income in case a long life is attained.

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ABRISS DER ALGEBRA DER LOGIK. Von Dr. Eugen Müller. Part I. Complete in three parts. Leipzig: Teubner, 1909.

Since Boole wrote his learned book on *The Laws of Thought* a new science has originated which lies on the borderland of mathematics and logic, and contains the most abstract thought. The most prominent thinker in

modern times who has built up this new realm is the late Dr. Ernst Schroeder, professor of mathematics at the Polytechnic school at Karlsruhe in Baden. He wrote a voluminous book on *The Algebra of Logic* and his main rival in this field of most abstract thought is the American scholar Charles S. Peirce, who uses the term "the logic of relatives." Since Professor Schroeder's death, Dr. Eugen Müller of Constance has been in charge of his manuscripts, and he has undertaken to condense the great work of Schroeder into small compass so as to make the main principles of the new science accessible to those who would not have the time to wade through the books of Boole and of Schroeder. He condenses Schroeder's *Algebra of Logic* into about 150 pages, which is to appear in three installments, the first of which, comprising 50 pages lies now before us.

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THE NEW SCHAFF HERZOG ENCYCLOPEDIA OF RELIGIOUS KNOWLEDGE. Edited by Samuel Macauley Jackson, DD., LL.D. (Editor in Chief), Charles C. Sherman, Geo. W. Gilmore, and others. Vol. III, Chamier—Draendorf. New York: Funk & Wagnalls, 1908-1909. Pp. 500. Price, per vol., cloth \$5.00; per set \$60 to \$108.

We are glad to welcome the third volume of this valuable work. It is the expectation of the publishers to continue issuing a new volume from the press every three months until the work shall be complete in twelve volumes. The present volume is of very especial interest as will be clear to any one who considers the possibilities of the initial letter C. Charlemagne, Christ, Christian, Christology, Church, Confession, Confirmation, Constantine, Councils, Creation, Creed, Cross, Crucifixion and Crusades are a few suggestive titles, bringing many others in their train, and all are treated with the same special thoroughness that characterizes the management of the work as a whole. The usual bibliographies are supplied at the end of each item and the volume contains a supplemental bibliographical appendix which brings the list of books covering the topics from Vol. I to the end of Vol. II down to January, 1909, thus placing the latest published information available at the disposal of the reader.

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THE PLACE OF ANIMALS IN HUMAN THOUGHT. By Countess Evelyn Martinengo Cesaresco. London: Fisher Unwin, 1909. Pp. 376. Price, 12s. 6d. net.

To the lover of animals this book will open up a new field of interest. It is the result of the thought and investigation of several years on the part of the author, to whom the study and compilation has been a labor of love. A suggestion of Count Goblet d'Alviella at the Oxford Congress of the History of Religions last September, to the effect that the psychology of animals might have some bearing on the science of religions, confirmed Countess Martinengo-Cesaresco in her belief in the importance of animal psychology. Her discussion treats of the views of the various nations of the earth on the subject, under the following headings: Soul-Wandering as It Concerns Animals, The Greek Conception of Animals, Animals at Rome, Plutarch the Humane, Man and His Brother, The Faith of Iran, Zoroastrian Zoology, A Religion of Ruth, Lines from the Adi Granth, The Hebrew Conception of Animals, "A People Like Unto You," The Friend of the Creature, Versi-

pelles, The Horse as Hero, Animals in Eastern Fiction, The Growth of Modern Ideas About Animals.

A valuable feature of the work consists in the illustrations which have been gleaned from widely divergent and often recondite sources, and represent Egyptian, Assyrian, Grecian, Roman, Iranian, Arabian, Hebrew, Buddhist and also prehistoric conceptions of animals. Orpheus and St. Francis are of course named among "The Friends of the Creature," and Hubert Van Eyck's painting of St. Jerome extracting a thorn from the paw of a lion is one of the interesting illustrations reproduced. The frontispiece to the volume is a photogravure from a tempera painting from Abul Fazl's *Akbar Namah*, now in the India Museum, and represents the Emperor Akbar personally directing the tying-up of a wild elephant. Unfortunately a cursory search does not reveal in the text any mention of Akbar's clemency and fondness for animals and his efforts to improve the various breeds, especially of horses and elephants. A similar incident to the one illustrated in Countess Martingengo-Cesaresco's frontispiece is graphically described in Dr. Richard von Garbe's *Akbar, Emperor of India*, reprinted in pamphlet form from *The Monist* of April, 1909.

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L'ANNÉE BIOLOGIQUE. Comptes rendus annuels des travaux de biologie générale. Publiés sous la direction de *Yves Delage*. 10me année, 1905. Paris: Le Soudier, 1908. Pp. 500.

This important annual has changed its arrangement to some extent with this issue, in so far as its editors have thought best to omit the general review, more or less extensive, which has customarily preceded the volume as a whole, and they now limit themselves to a short notice indicating certain main points upon which biologists are concentrating their attention, and the principal works that bear upon these subjects. In its table of contents this volume gives a list of the "general reviews" included in all the preceding numbers.

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AIDS TO WORSHIP. By *Malcolm Quin*. Newcastle-On-Tyne: T. M. Grierson. Pp. 182. Price, One Shilling net.

The secondary title "An Essay Towards the Positive Preservation and Development of Catholicism" is somewhat equivocal since it does not also define the author's point of view with regard to Catholicism. He states more clearly in the preface that he might have described the work as "An Essay on the Religious Interpretation of Auguste Comte" which would certainly have defined the scope and purpose of the work much more definitely, and would have been a guide to the reader as to the direction in which his further perusal of the book would lead him. A third of the volume is devoted to the introduction, and the "Aids" themselves have for a motto the verse, "Ye therefore shall be perfect as your Heavenly Father is perfect."

The book is really a manual of study and religious training for the Positivistic Religion of Humanity, founded by Comte, and the different subjects treated are discussed in terse dogmatic paragraphs with marginal headings, such as The Purpose of Worship, Perfection and Goodness, The Perfect Being, The Mystery of Evil, The Mystery of Human Freedom, The Humanity of God, The Paternity of God, God the Son, The Christ of Worship, The



Inheritance of Religious Speech, the Commemoration of Christ, The Divine Presence in the Eucharist, Commemoration of non-Christian humanity, The Universal Scriptures, Worship a Good in Itself, and many other similar topics. The same author has published a book of *Offices of Public Worship* for congregations of the Religion of Humanity.

DER SKEPTIZISMUS IN DER PHILOSOPHIE UND SEINE UEBERWINDUNG. Von Raoul Richter. Leipsic: Dürr, 1908. Pp. 584, Price, 8 m. 50.

Now we have the second volume of this exhaustive work of Professor Richter, and this volume comprises the second, third, and fourth parts of the first book. The study of skepticism is taken up chronologically, beginning with the period of the Renaissance, which represents naturalistic skepticism, the most conspicuous exponents of which are Montaigne and Charron; then follows the empirical skepticism of the 18th century and a discussion of the relation between modern philosophy and skepticism from Bacon to Leibnitz, including Descartes, Spinoza, Locke and Berkeley and giving special attention to an exposition and critique of the skepticism of Hume.

The fourth part discusses the biological skepticism of the 19th century, first from Hume to Hegel, including a section on positivism, followed by a chapter on the life and teachings of Nietzsche. The first book treats of total skepticism (*der totale Skeptizismus*). The second book is announced at the end of this volume and will treat of *Der partielle Skeptizismus*.

SOCIOLOGIE DE L'ACTION. Par Eugène de Roberty. Paris: Alcan, 1908. Pp. 355. Price, 7 fr. 50.

The latest contribution of Professor De Roberty's many works on sociology is the present discussion of the sociology of action, which he treats in two divisions; first the social genesis of reason, and second, the rational sources of action. In this volume he continues to emphasize his opposition to the timidity and equivocations of contemporaneous sociological thought, which was one of his principal objects in his former works on the "Constitution of Ethics" and the "New Program of Sociology." He feels the necessity of this very strongly, and he regards it as a more important fact in the realm of knowledge than in that of action, that not to advance means to retrograde.

ZUR WIEDERGEURT DES IDEALISMUS. Von Jakob Schmidt. Leipsic: Dürr, 1908. Pp. 325. Price 6 m.

These studies have grown out of a struggle on behalf of idealism against the modern idols of "psychologism, historicism and positivism." A few of the titles of the fifteen studies here included are as follows: Capitalism and Protestantism; Mediæval Character of Ecclesiastical Protestantism; Theoretical Positivism; Harnack and the Resuscitation of Speculative Inquiry; Experience and Poetry; Goethe and Antiquity; Kant and Speculative Mathematics; The Education of Women, and Classical Antiquity.

WITelo, EIN PHILOSOPH UND NATURFORSCHER DES XIII. JAHRHUNDERTS. Von Clemens Baeumker. Münster: Aschendorff, 1908. Pp. 686. Price 22 m.

This work is Part II of the third volume of "Contributions to the History of Mediæval Philosophy," and contains the Latin text of Witelo's *Liber de*



*Intelligentiis* together with critical textual notes. This is followed by important philosophical excerpts from the philosopher's *Perspectiva*. Part II is the descriptive and critical portion of the work and after a biographical chapter discusses Witelso's smaller writings and the philosophy of the *de Intelligentiis* as well as its place in the history of philosophy. A short chapter is also given to the significance of *Perspectiva* in the history of philosophy.

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LES ERREURS DE LA SCIENCE. Par L. C. E. Vial. Paris: Vial, 1908. Pp. 450. Price, 3 fr. 50.

This work is an exposition of a system of natural philosophy which attempts to unify all sciences by submitting them to the mechanical and contradictory principle of the "unit-couple," and to demonstrate by scientific testimony the part of man in creation, and the bond which unites him directly to the Creator, the life-principle and source of life. The first part deals in questions of mechanics and its relation to physiology proceeding likewise to the discussion of psychological questions. The second part deals with cosmic problems, defines the atom and describes the mechanism of electrolysis and radio-activity. It further discusses the nature of atmosphere, water, and earth and the parts they play in the author's cosmogonic conception.

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COURNOT ET LA RENAISSANCE DU PROBABILISME AU XIX. SIÈCLE. Par F. Mentré. Paris: Rivière, 1908. Pp. 649. Price, 12 fr.

This work is recommended to the interest of the public both by the name of Cournot himself and the high value of the Library of Experimental Philosophy to which it belongs. The author here expounds the ruling ideas of Cournot's philosophy, his theory of order and chance, his "probabilistic" method, his philosophy of the sciences and his views on religion and ethics. The attempt has also been made to indicate the rise of these ideas and to characterize the range of their influence. The book is of a special value because Cournot's works have become inaccessible, and this volume contains the substance of his investigations.

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Prof. C. J. Ball, of Oxford, has written a most learned and at the same time interesting article on "The Accadian Affinities of Chinese" in which he offers an irrefutable proof that the founders of the Babylonian civilization, the people of Sumer and Accad, furnished the materials from which the Chinese civilization has grown. He announces that his investigations will "convince the learned world of the truth of the theory that the Chinese writing had a Western origin, and that the Chinese language is the nearest living representative of the ancient Accadian. Already in 1871 Edkins could assert the probable consanguinity of the early Chinese with the 'Cushites' of Babylonia, and could state that 'many ancient customs point to a connection once existing between Western Asia and China.' That scholar, in fact, assumed, on the ground of resemblance in the principal elements of civilization, and altogether independently of the special considerations which are submitted in this paper, that the primitive Chinese were immigrants from the plain of the Euphrates, who entered their present country some five thousand years ago...

"Perhaps the first thing that strikes one in a comparison of the two

languages is the unusual number of common words. A few coincidences of sound would, of course, prove little or nothing, because such may be found in almost any pair of languages. The old Chinese *kot*, *kut*, is strangely like not only the Accadian *kud*, but also the English 'cut.' But while we may leave such correspondences, in cases where they are few and far between, to the diviners of the primeval speech, we can hardly do that in cases where the majority of words in both languages can be shown to be cognate or even identical. Number eliminates chance.

"Again, no argument for near kindred or identity can be based solely upon Accadian terms like *aba*, *ama*, as compared with the old Chinese *pa*, *ma*, 'father,' 'mother'; because such sounds may be paralleled from a multitude of tongues of every class and kind. The case, however, is different with such similarities as exist between the Accadian *sag* (*shag*), *zag*, 'head,' and the Chinese *sheu*, *sù*; between Acc. *shem*, *shab* (= *sham*), *shag*, *sha*, 'heart,' and Ch. *sām*, *sang*; between Acc. *shu*, 'hand,' and Ch. *sheu*, *shu*. Not much reflection is necessary to see that there must be a real connection between these common words, and that a fortuitous likeness of this kind is an improbable contingency. These coincidences, however, amount to hundreds, and practically exhaust the available vocabulary of Accadian."

Volume IV of the University of California Publications on Education consists of the second part of Milicent Washburn Shinn's *Notes on the Development of a Child*, treating in particular of "The Development of the Senses in the First Three Years of Children." The author's original data came from a journal of the development of a single child closely observed by her during the whole period of the record, but these data have been supplemented by the observations of others which in some points have become the basis of her conclusions more than her own record, because in these particulars her own notes were insufficient or because the facts had been already so well established that her particular observations could do little more than corroborate. Part One investigates the "Sensibility of the New Born" with regard to each of the senses; Part Two, the "Synthesis of Sense Experience"; Part Three, "Development in Discrimination and Interpretation."

It is customary at present to analyze the psychological disposition of philosophers, and religious leaders, and so a book by Jacob H. Kaplan on the *Psychology of Prophecy* (Philadelphia: Julius H. Greenstone, 1908), will be welcome. It is intended to be a study "of the prophetic mind as manifested by the ancient Hebrew prophets," the author being a Rabbi who handles his subject not only scientifically but also with reverence and discretion, and this makes the book more valuable.

Jonas Cohn, professor at the University of Freiberg, i. B., who has devoted much thought to the solution of the problem of infinitude, discusses in his recent book, *Voraussetzungen und Ziele des Erkennens* (Leipsic: Engelmann, 1908), the significance of logic as a basis of all philosophy. He proposes to expose the various fibers which connect logic organically with the several parts of philosophy.

